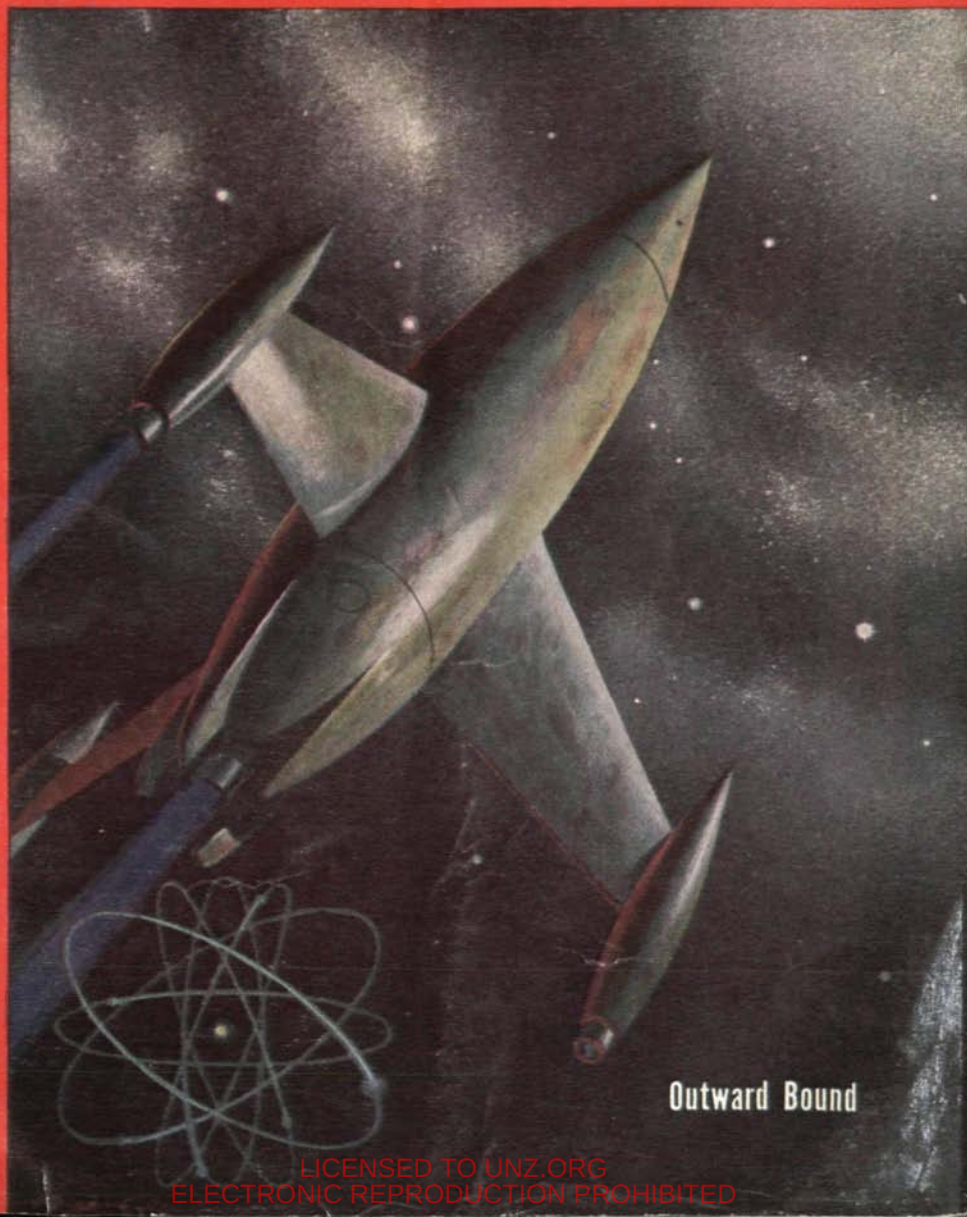


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PRIMITIVE LANGUAGE

Anthropologists and linguists have reported from various parts of the world that many primitive people have languages that do not appear to have specific words for things of some categories, and have nothing but specific—and no general—words for other things. Thus, in many primitive languages, there is no word that can properly be translated as the English word “water,” but rather a series of words, usually interpreted by such phrases as “water from the sky” or “rain,” “water in the sea,” “water in the stream” and so on.

Not being an anthropologist, and never having studied one of those primitive peoples, I certainly can't say—but I have a personal hunch. And I know this: a language *could* be constructed on a very different basis from that of English, German, or any of the major languages of the Earth—a really different basis.

Consider this: In English, we have a language with terms which describe objects and external situations. We have the term “water” which corresponds with the chemist's term “H₂O”. It's an external-universe thing. But I have various experiences: the

cool, satisfying wetness of a drink on a hot day; the unpleasant, depressing wetness of walking home in the rain when I've been caught out; the almost-flying feeling, completely pleasant, of swimming on a hot summer day. These sensations-feelings—i.e., physical sensation and emotional response—are totally different. True, each was stimulated by the presence of a certain chemical substance, H₂O, but the difference in the sensation-feeling is vast. To me, as a human being, that difference is, actually, immensely more noticeable than the similarity of the chemical substance.

I might well build up a language—which is a system of mutually agreed on sound-symbols in its original state—which expressed the internal-world sensation-feeling, rather than communicating the external-world object. Then I might call the cool, wet satisfaction of a drink *aba*; the unpleasant, chilling-depressing damp of rain *boota*; and the entirely pleasant sensation of half-flying in a lake or stream *polab*. Three different words, for three very different sensation-feelings. Of course, if a chemist came along, he could

properly say "You're referring to hydrogen oxide," and yet he would be quite entirely wrong. I'm not at all; he's referring to the chemical substance which stimulated the sensation-feeling I was referring to when I said "aba," or "boota," or "polab".

Now whether there actually is any language on Earth that is based on that sort of orientation, I, not being an anthropologist, can't say. But I can say that such a language could be built up. And I can speculate on some of its consequences.

Those interested in General Semantics please take note! It would involve a complete reorientation of the individual's personality, his outlook on life. With such a language, the cultural pattern developed would be such that the idea of chemical analysis, or physical science, would be very slow starting indeed. How could one analyze *aba*? The idea itself would "make nonsense." It could only be done by introspection, and philosophical discussion. For one thing, *aba* might arise from drinking beer, save that the properly flexible language of such a type would have another word, perhaps *beraba*, to specify the additional satisfactions obtained in that way. Such a language would lead the mind away from the realization of the similarity of stimulus-material in *aba*, *boota*, et cetera. Rigorous analysis of the external world would be very much delayed in starting.

On the other hand, the objective

languages like English, and all the major world languages, have immense difficulty in expressing clearly differences in sensation-feeling. The difficulties are so great, in fact, that anyone who does competently do so is considered a very great poet indeed. Only with the greatest difficulty—and by continuous reference to external-world objects having implied emotional-feeling effect—can that sensation-feeling be transmitted. "The Old Oaken Bucket" isn't an ode to an object at all—it's an ode to the cool, thirst-quenching satisfaction feeling of a drink of good well-water. Actually, the whole message of "The Old Oaken Bucket" is—*aba*. But such a time as the poet has, describing objects and moss and so on, trying to recreate a simple, deep human sensation-emotion experience!

Such a language would, by its nature, make any real advance in physical science almost impossible.

On the other hand, it might lead to the development of a real sociological and psychological science, instead of our present, exceedingly inadequate and horribly fumbling attempts.

While our type of language has led us to the triumph of atomic energy—it is in the forms of bombs, with no social understanding adequate to control them.

I'm a little curious as to which type of language *should* be considered the more primitive?

THE EDITOR.

DUNE ROLLER

BY J. C. MAY



Illustrated by J. C. May

The Roller was a myth; the Roller was a Thing. The Roller was poppycock and nonsense. But something happened to those strange little bits and pieces . . .

There were only two who saw the meteor fall into Lake Michigan, long ago. One was a Pottawatomie brave hunting rabbit among the dunes on the shore; he saw the firestreak arc down over the water and was afraid, because it was an omen of ill favor when the stars drowned themselves in the Great Water. The other who saw was a sturgeon who snapped greedily at the meteor as it fell — quite reduced in size by now — to the bottom of the fresh water sea. The big fish took it into his mouth and then spat it out again in disdain. It was not good to eat. The meteor drifted down through the cold black water and dis-

appeared. The sturgeon swam away, and presently, he died . . .

Dr. Ian Thorne squatted beside a shore pool and netted things. Under the July sun the lake waves were sparkling deep blue far out, and glass-clear as they broke over the sandbar into Dr. Thorne's pool. A squadron of whirligig beetles surfaced warily and came toward him, leading little v-shaped shadow wakes along the tan sand bottom. A back-swimmer rowed delicately out of a green cloud of algae and snooped around a centigrade thermometer which was suspended in the water from a driftwood twig.

3:00 p.m., wrote Dr. Thorne in a large, stained notebook. *Air temp 32, water temp* — he leaned over to get a better look at the thermometer and the back-swimmer fled — 28 *Wind, light variable; wave action, diminishing. Absence of drifted specimens.* He dated a fresh sheet of paper, headed it "Fourteenth Day," and began the bug count.

He scribbled earnestly in the sun, a pleasant faced man of thirty or so. He wore a Hawaiian shirt and shorts of delicious magenta color, decorated with most unbotanical green hibiscus. An old baseball cap was on his head.

He skirted the four-by-six pool on the bar side and noted that the sand was continuing to pile up. It would not be long before the pool was stagnant, and each day brought new and fascinating changes in its population. *Gyrinidae, Hydrophilidae, a Corixa* hiding in the rubbish on the other end. Some kind of larvae beside a piece of waterlogged board; he'd better take a specimen or two of that. *L. intacta* sunning itself smugly on the thermometer.

The back-swimmer, its confidence returned, worked its little oars and zigzagged in and out of the trash. *N. undulata*, wrote Dr. Thorne assiduously.

When the count was finished, he took a collecting bottle from the fishing creel hanging over his shoulder and maneuvered a few of the larvae into it, using the handle of the

net to herd them into position.

And then he noticed that in the clear, algae-free end of the pool, something flashed with a light more golden than that of mere sun on water. He reached out the net to stir the loose sand away.

It was not a pebble or a piece of chipped glass as he had supposed; instead, he fished out a small, drop-like object shaped like a marble with a tail. It was a beautiful little thing of pellucid amber color with tiny gold flecks and streaks running through it. Sunlight glanced off its smooth sides which were surprisingly free of the surface scratches that are the inevitable patina of flotsam in the sand-scoured dunes.

He tapped the bottom of the net until the drop fell into an empty collecting bottle and admired it for a minute. It would be a pretty addition to his collection of Useless Miscellaneous. He might put it in a little bottle between the tooled brass yak bell and the six-inch copper sulfate crystal, or perhaps even have it made into a bangle for Rosemarie, if she ever decided to forgive him.

Rosemarie. Dr. Thorne had stormy memories of her corn-gold hair and flashing eyes. But she was gone, and for the hundredth time he cursed his thoughtless, stupid mistake that had brought first the hurt, then a new look into her eyes and sent her floating away from him, leaving a mocking little wisp of a smile and a memory of

beautiful, bright golden hair.

Rosemarie, Rosemarie. He could have explained. He would still. But she was gone. Carefully, he corked the bottle with the golden drop and placed it among the others in the creel. It would go in a little bottle on the shelf, between a bell and a blue crystal the color of her eyes.

It was just as he was collecting his equipment before leaving that the boat came. It swept up out of the north and nosed in among the sand bars offshore — a dignified, forty-foot Matthews cruiser named *Carlin* that belonged to his friend, Kirk MacInnes.

"Hoy, Mac!" Dr. Thorne yelled cordially. "Look out for the new bar the storm brought in!"

A figure on the flying bridge of the boat waved briefly and howled something unintelligible around a pipe clamped in its teeth. The white cruiser swung about and the mutter of her motors died gently. She lay rocking in the little waves a few hundred feet offshore. After a brief pause, a yellow rubber raft dropped over the stern.

Good old Mac. The irreverent little ex-engineer with the Skye terrier mustache and the magnificent boat visited him regularly, bringing the mail and his copy of *Monthly Review of Biology*, or bottled goods of a chemistry designed to prevent isolated scientists from catching cold. He was a frequent and welcome visitor, but he had always come alone.

Previous to this.

"Well, well," said Dr. Thorne, and then looked again.

She sat in the stern of the raft while MacInnes paddled deftly, and as they drew closer he saw that her hair was dark and curly. She wore a spotless white playsuit, and a deep blue handkerchief was knotted loosely around her throat. She was looking at him, and for the first time he had qualms about the Hawaiian shorts.

The yellow flank of the raft grated on the pebbly beach. MacInnes, sixty and grizzled, a venerable briar between his teeth, climbed out and pumped Thorne's hand.

"Brought you a visitor this time, Ian. Real company. Jeanne, this gentleman in the shorts and fishing creel is Dr. Ian Thorne, the distinguished writer and lecturer. He writes books about dune ecology, whatever that is. Ian, my niece, Miss Wright."

Thorne murmured politely. Why, that old scoundrel. That sly old dog. But she was pretty, all right, though in a — different way.

"How engaging," smiled the girl. "An ecologist with a leer."

Dr. Thorne's face abruptly attempted to adopt the protective coloration of his shorts. He said, "We're really not bad fellows at heart, Miss Wright. It's the fresh air that gives us the pointed ears."

"I see," she said, in a tone that made Thorne wonder. "Were you collecting any particular specimens

here today, Dr. Thorne?"

"Not exactly. You see, I'm preparing a chapter on the ecology of beach pool associations, and this little pool here is my guinea pig. The sand bar on the lake side will grow until the pool is completely cut off. As its stagnation increases, progressive forms of plant and animal life will inhabit it — algae, beetles, larvae and so forth. If we have calm weather for the next few weeks, I can get an excellent cross section of the plant-animal societies which develop in this type of an environment. The chapter on the pool is for a book I'm doing on ecological studies of the Michigan dunes."

"All you have to do is charge him up," MacInnes remarked, yawning largely, "and he's on the air for the rest of the day." He pulled the raft up onto the sand and took out a flat package wrapped in brown paper. "I brought you something, if you're interested."

"What is it? The *Review*?"

"Something a heck of a lot more digestible. A brace of sirloins. I persuaded Jeanne to come along today to do them up for us. I've tasted your cooking."

"I can burn a chop as well as the next man," Thorne protested with dignity. "But you do have a point there. I was finished here anyway — would you like to go right down to the shack? I live just down the shore, Miss Wright, in a place perched on top of a sand dune. It's rugged, but

for me, at least, it's home."

MacInnes chuckled rudely and led the way along the firm, damp sand near the water's edge.

In some places the tree-crowned dunes seemed to come down almost to the beach level. Juniper and pines and heavy undergrowth were the only things holding the vast creeping monsters which were the traveling dunes. Without their green chains, they swept over farms and forests, leaving dead trees and silver-scoured boards in their wake.

The three of them cut inland and circled a great narrow-necked valley which widened out among the high sand hills. It was a barren, eerie place of sharp, wind-abraded stumps and silent white spaces.

"A sand blow," said Thorne. "The winds do it. Those dunes at the end of the valley in there are moving. See the dead trees? The hills buried them years ago and then moved on and left these skeletons. These were probably young oaks."

"Poor things," said the girl.

Then the dismal blow was gone, and green hills with scarcely a show of sand towered over them. Down one of the slopes came a stairway of hewn logs. At its foot stood a wooden bench, a bright green pump, and an old ship's bell on a pole.

"A dune's doorbell!" Jeanne exclaimed, seizing the rope.

"Nobody home yet," Thorne

laughed, "but the shack is right up there on a bluff overlooking the lake."

"Yeah," said MacInnes sourly. "And a hundred and thirty-three steps to the top!"

The rustic exterior of Dr. Thorne's lodge blended inconspicuously into the conifers and maples which surrounded it on three sides. The front of the house, its screened porch commanding a magnificent view of the lake, was banked with yew and prostrate juniper for sand control.

Later, they sat in comfortable rattan chairs on the porch and Thorne manipulated siphon and glasses.

"You really underestimate yourself, Dr. Thorne," the girl said. "This is no shack, it's a real house — a lodge in the pines."

"Be it ever so humble," he smiled wryly. "I came up here to buy a two-by-four cabin to park my typewriter and microscopes in, and a guy wished this young chalet off on me."

"It has a wonderful view. You can see for miles."

"But when the wind blows a gale off the lake, you think the house is going to be carried away! It's just the thing for my work, though. No neighbors, not many picnickers, not even a decent road. I have to drive my jeep down the beach for a couple of miles before I can hit the cow path leading to the county trunk. No telephones either. And I have my own little generating plant out back, or there'd be no electricity."

"Real rural," put in MacInnes.

Jeanne frowned. "No phone? But Uncle Kirk says he talks with you every day. I don't understand."

"Come out here," he invited mysteriously. "I'll show you something."

He led the way to a tiny room with huge windows which lay just off the living room. Radio equipment stood on a desk and lined the walls. A large plaster model of a grasshopper squatting on the transmitter rack wore a pair of headphones.

"Ham radio used to be my hobby when I was a kid," he said, "and now it serves the useful purpose of keeping me in touch with the outside world. I met Mac over the air long before I ever saw him in the flesh. You must have seen his station at home. I think he even has a little low-power rig in the cruiser."

"I've seen that. Do you mean he can talk to you any time he wants to?"

"Well, it's not like the telephone," Thorne admitted, "the other fellow has to be listening for you on your frequency. But your uncle and I keep a regular schedule every evening and sometimes in the morning. And hams in other parts of the country are very obliging in letting me talk to my friends and colleagues. It works out nicely all the way around."

"Uncle Kirk had you represented as a sort of scientific anchorite," she said, lifting a microphone and running her fingers over the smooth

chrome. "But I'm beginning to think the joke is on me."

"Maybe," he said quietly, "maybe not. I manage to get along. The station is a big help, but — there are other things. Shall we be getting back to the drinks?"

She put the microphone down and looked at him oddly. "If you like. Thank you for showing me your station."

"Think nothing of it. If you're ever in a jam, just howl for W8-Dog-Zed-Victor on ten meters."

She laughed, with a sound like ice in a pitcher, and that mockery he had known before looked out of her gray eyes.

"All right," she said to him. "If I ever am." She turned and walked out of the door.

The casual remark he had been about to make died on his lips, and suddenly all the loneliness of his life in the dunes loomed up around him like the barren walls of the sand blow. And he was standing there with the dead trees all around and the living green high out of reach.

He wanted to punch MacInnes' face for bringing this girl here. He wanted to crush her and kiss the mockery out of her eyes. He wanted to yell and smash things and take the jeep and drive away from this place. Oh, Rosemarie. But she was gone.

"This Scotch tastes like iodine," said MacInnes loudly, from the porch.

Thorne left the little room and closed the door behind him. "It's the only alcohol in the house, unless you want to try my specimen pickle," said Thorne, dropping back into his chair. "As for the flavor — you should know. You brought the bottle over yourself last week."

Ha. That shut him up.

The girl took Thorne's creel and began to arrange the bottles in rows on the table. Algae, beetles, and some horrid little things that squirmed when she shook them. *Ugh.*

"What's this?" she asked curiously, holding up the bottle with the amber drop.

"Something I found in my beach pool this afternoon. I don't know what it is. Rock crystal perhaps, or somebody's drowned jewelry."

"I think it's rather pretty," she said admiringly. "It reminds me of something, with that little tail. I know — Prince Rupert drops. They look just like this, only they're a bit smaller and have an air bubble in them. When you crack the little tail off them, the whole drop flies to powder." She shrugged vaguely. "Strain, or something. I never saw one that had color like this, though. Just look at the way the light sparkles off the little gold specks in it. It's almost like a piece of Venetian glass."

"Keep it, if you like," Thorne offered. He had decided he didn't like the associations it brought.

MacInnes poured himself another

finger and thumb of Scotch and scrupulously added two drops of soda. In the center of the table, the small amber eye winked faintly in the dying sunlight.

Young Master Harry Dittberner was not a cry-baby. He was nine, and almost a man. But he loved little animals a lot, too.

He liked to walk down the shore after dinner until the sun went down redly in back of Michigan, and watch the sand toads play. There were hundreds of them that came out to feed as soon as dusk fell — little silvery-gray creatures with big jewel eyes, that swam in the mirror of the water and sat so quietly on his hand when he caught them.

Harry came to Port Grand in the summer, and lived in a cottage near the town. He knew he was not supposed to go too far from home, but it seemed to him that there were always more and bigger toads just a little farther down the shore.

He would go just down to that sand spit, that was all. Well, maybe to that piece of driftwood down there. He wasn't lost, like his mother said he would be if he went too far. He knew where he was; he was almost to the Bug Man's house.

The Bug Man was funny. He lived all by himself and never talked to anyone — at least that's what the kids said. But Harry wasn't too sure about that. Once the Bug Man and a pretty

lady with black hair had been hiking in the dunes near Harry's cottage and Harry had seen the Bug Man kiss the pretty lady. Boy, that had been something to tell the kids!

Here was the driftwood, and it was getting dark. He had been gone several hours, and if he didn't get home, Mom was going to give it to him, all right.

The toads were thicker than ever, and he had to walk carefully to avoid stepping on any of them. And then he saw it in the sand, down near the water's edge. He knelt down swiftly and peered closely at what was lying there.

No, he was not a cry-baby. But the quick tears of sympathy which flooded his eyes almost seemed to blind him.

Oh, the poor toad. The poor little thing. He crouched there, blinking hard, and wondered whether he could do anything, or whether it was already dead. The feeble movement of a little leg decided him in an instant. He scooped the animal up tenderly in both hands and ran pell-mell over the top of the low shore dune to the foot of the hill where the Bug Man lived.

Thorne opened the door to stare astonished at the little boy, wondering whether or not to laugh. Tears had made little stripes of cleanness down a small dirty face, and his T-shirt had parted company from the belt of his jeans. He held out the in-

jured toad in front of him and both his small hands were covered with its blood. Without a word, Thorne opened the door and motioned the boy in.

"It's h-hurt awful bad, m-mister," he said, in a voice that was half gasp, half snuffle. "Can you make it well?"

"Now we'll have to see what's wrong first. You go wash your face and hands in the kitchen and take a coke out of the icebox."

Thorne sponged the blood from the white belly of the toad. A wide, red-mouthed wound had laid open almost the whole of its abdomen. He couldn't imagine why it was still alive, but it was certainly useless to let it suffer any further. He chloroformed it gently and stretched it out on the table for examination.

"It's dead, ain't it," said a sorrowful voice behind him.

"I'm afraid so, Sonny," Thorne admitted. "It was very badly hurt."

The little boy nodded gravely. "I had a dog once, got hit by a car. They took him away from me. They said it wouldn't be right to let him live any longer. Was it the same for the toad?"

"Yes."

He was silent for a minute. Then he said, "What was the matter with it, mister?"

Forceps and dissecting needle flashed under the table light. "Well, you see, sometimes by looking inside of the sick thing that has died, you can find out what was wrong.

That's what I'm doing now." The instruments clicked within the redness of the wound and parted the torn organs under the light.

Thorne arose suddenly and smiled kindly at the unhappy face before him. "I won't be able to do any more tonight, young fellow. And besides, it's getting dark and your mother will be worried about you. You wouldn't want her to think anything had happened to you, would you? No, I didn't think so. A big boy like you doesn't worry his mother."

From the half-darkness, a sniff.

"I'll tell you what. We'll drive home in my jeep. Would you like that?"

"I . . . I guess so."

"And I'll tell you about the time I was doing a hitch in the Navy and had to bail out of my plane into a coral lagoon full of sharks."

"Gosh!"

The screen door slammed behind them. The kid would forget the toad quickly enough, Thorne told himself. He couldn't have seen what was inside it anyway.

". . . And so there I was, swimming like mad. The sharks had eaten everything I had on except my skivvy shirt and my shoelaces, and one big fellow was licking his chops and following me, real slow —"

In the lodge later, under the single little light, Thorne preserved the body of the toad in alcohol. Beside him on the table gleamed two tiny

amber drops which he had removed from the seared and ruptured remains of the toad's stomach.

Mr. Gimpy Zandbergen, gentleman of leisure, late of the high sea and presently of the open road, was going home. During a long and motley life, Mr. Zandbergen had wandered far from his native lakes to sail on more boisterous waters; but now his days as an oiler were over and there came into his heart a nostalgic desire to see the fruit boats ship out of Port Grand once more. Since he possessed neither the money for a bus ticket home, nor the ambition to work to obtain it, he pursued his homeward way via freight cars and such rides as he was able to hook from kindly disposed truck drivers.

His last ride carried him to a port on the shore highway some miles south of his goal, at which point he had regrettably disputed the intrinsic worth of the Detroit Tigers and had been invited to continue his journey on foot. But Mr. Zandbergen was a simple soul, so he merely shrugged his shoulders, fortified himself from the bottle in his pocket, and trudged along cheerily enough.

It was hot, though, as only Michigan in August can be, and the sun baked the concrete and reflected off the sand hills at the side of the road. Passing cars became fewer and fewer as he left the village behind, and after a while he had the road to himself.

Refreshing himself frequently, Mr. Zandbergen began to occupy his mind with cool thoughts. He dwelt delightfully on the run to Murmansk, sleet storms off Hatteras, and refrigerated holds. Presently, he sang:

*"On the Eighteenth in the morning
And what I saw was true,
The ice upon the rigging froze
And the cold wind fiercely blew.*

*"But no one thought that in two short
hours
That very afternoon,
Some would be froze and some be
drowned:
The Antelope was doomed."*

He paused, pulled a blue bandana handkerchief from his pocket, and mopped his balding head under his cap. He thought longingly of the cool dune path which he knew lay on the other side of the forest, toward the lake. It had been a long time, that was true, but he knew he remembered it. It would lead to the road to Port Grand and the fruit boats, and it would be cool — deliciously, delightfully cool. Again, music echoed among the dunes:

*"And only one of that gallant crew
Was in life once more to stand,
And for miles and miles the Antelope
Lined the shores of Michiga-a-an!"*

In Port Grand in the afternoon, the harbor tightened up for a blow.

The smaller boats disappeared into the slips along the river like mice before a cat, and the larger craft and the freighters threw out an extra anchor and rolled uneasily in the oily water.

"She's coming down like a lead balloon," Kirk MacInnes observed, peering at the barometer in the living room of his home on the river. He

spoke to no one in particular, and the house was calm and quiet except for disconnected female noises emanating from the general direction of the kitchen.

"Selkirk!" said a distant voice. "Did you bring the geraniums in off the porch?"

"Yes, my love."

He hadn't. He looked out of the



window and the blue sky had turned a bit hazy perhaps, though he could scarcely notice it. It didn't *feel* like a storm, with the sparrows chirping and the trees shimmering unmoving in the heat. He stepped leisurely onto the porch and rescued the geraniums from their exposed wall brackets. Then he set them in the middle of the lace dining room tablecloth.

Bong, said the Seth Thomas on the wall. Time for his QSO with Ian Thorne. He liked young Thorne. He was a good lad. Pity he was stuck away in the dunes like that, but that was his business. MacInnes couldn't see why a young man would hole up in the sand and chase bugs. Perhaps one could say that the little Scotchman lacked an open mind. But then he did possess a rarer commodity — a closed mouth.

Besides, he had tried to see that things weren't too dull for Thorne after all. MacInnes permitted himself a self-satisfied smirk. Yes, the young people saw quite a bit of each other. Jeanne had even had a little chain fixed to the amber drop Thorne gave her and had hung it in the *Carlin's* deckhouse for a good luck charm.

He laughed to himself. Get 'em together, that was the stuff. Best thing in the world.

Ellen, his plump little wife, bounced into the room, saw the geraniums and began to scold vigorously. She had on a frilly apron and her gray curls

were askew. He gave her a hug as he swooped past her up the stairs.

"Why, Selkirk MacInnes!" she cried after him.

Still chuckling, he warmed up the great thousand-watt transmitter he had made with his own hands, and while waiting, checked the coastguard frequency for the weather report. It came in clear and strong, a northwest storm warning for Muskegon, Port Grand and Holland. It would hit them before nightfall.

He sighed, glanced reassuringly at *Carlin* out in the harbor, and began his call.

The marine chronometer on the wall of Thorne's amateur station said 5:15. His receiver said to him:

"I have to sign off now. The mis-sus is hollering up that she wants me to see to the windows before supper. I'll look for you tomorrow. This is W8GB over to W8DZV. W8GB is out and clear. Good night, Thorne."

Thorne said, "Good night, Mac. W8DZV out," and let the power die in his tubes. He lit a cigarette absently and stood looking out of the window at a single giant white thunderhead that hung over the lake like a marble spray billow, ponderous and sullen. The rising wind slipped whistling through the stiff branches of the evergreen trees on the dune, and dimly, through the glass, he could hear the sound of the waves.

He moped around aimlessly after

supper and waited for something to happen. He tidied up his workroom, tried to read a magazine, and then thought about Jeanne. She was a sweet kid, but he didn't love her. She was just something else to file away in the collecting bottles, neatly preserved in his heart.

The walls were up around him again, and the dead trees with the living green forever out of reach. She had looked at those white skeletons and said, "Poor things!"

The magazine flew across the room and disappeared behind the couch in a flutter of white pages.

He stormed into the workroom, bumped the shelves, and set the specimens in their bottles swaying sadly to and fro. In the second bottle from the end, right-hand side, was a toad. In the third were two small amber beads with tails, whose label said only:

YOU TELL ME . . . 8/5/57

Interest stirred. Now there was something. He had almost forgotten them. It looked pretty obvious that the beads had been the cause of the wound in the toad's belly. They had evidently affected the stomach and the surrounding tissues before they had had a chance to pass through the digestive tract. Fast work. He picked up the second bottle and moved it gently. The pale little thing inside rotated until the hole, with all the twisted organs plainly visible inside, faced him. Willy Seppel would have

liked to see this; too bad he was across the state in Ann Arbor.

Idly, Thorne toyed with the idea of sending the pair of drops to his old friend. They were unusual looking — he could leave the label on, write a cryptic note, and fix Seppel's clock for putting the minnows in his larvae pail on their last field trip together.

If he hurried he could get the drops off tonight. There was a train from Grand Port in forty-five minutes. As for the storm, it was still a long way off. He doubted that it would break before nightfall. And the activity would do him good.

He found a small box and prepared it for the mails. Where was that book of postal rates? The letter to Seppel; he slipped a sheet of paper into his typewriter and tapped rapidly. String. Where was the string? Ah, here it was in a magazine rack. Now a slicker, and be sure the windows and doors are locked.

His jeep was in a shed at the bottom of the dune, protected by a thick scrub of cottonwood and cedar. Since it lacked the dignity of a door, Thorne had merely to reverse gears, shoot out, swing around, and roar over the impoverished stone drive to the hard wet sand of the beach. Five miles down was an overgrown but still usable wagon trail which led to the highway.

With slicker flapping in the rising wind, Dr. Thorne and his jeep disappeared over the crest of a tall dune.

Mr. Gimpy Zandbergen was distinctly put out when the storm came. He had forsaken the road for a cooler path which ran parallel to it, through the woods, and when the sky darkened above the thick branches he had assumed that it was merely one of the common summer sun showers and hoped for a quick clearing.

He was disturbed when the big drops continued to pelt down among the oak trees. He was annoyed as his path led him out between the smaller and less sheltering evergreens. He swore as the path ended high on a scrubby hill.

Lightning slashed the black clouds and Mr. Zandbergen broke into a lope. He had taken the wrong turning, he knew that now. But he recognized this shore. He dimly remembered a driftwood shanty which lay near an old wagon road somewhere around here. If he hurried, he might not get too wet after all.

He could see the lake now. The wind was raging and tearing at the waves, whipping the once placid waters of Michigan into black fury. Gimpy shuddered in the driving rain and fled headlong down a dune. Great crashes of thunder deafened him and he could hardly see. Where was that road?

A huge sheet of lightning lit the sky as he struggled to the top of the next dune. There it was! Down there! And trees, and the shanty would be there, too.

He went down diagonally across the dune in gigantic leaps, dodging the storm-wracked trees and bushes. The wind lulled, then blasted the branches down ferociously, catching him a stinging blow across the face. He tripped, and with an agonized howl began to roll straight down the bare face of the sand hill toward a cottonwood copse and the two sand ruts in the brush that were the road. He landed in a prickly juniper hedge and lay whimpering and cursing weakly while the rain and wind pounded him. The greenery ripped from the trees stung into him viciously as he tried to rise, gave up, and tried again. On the black beach several hundred feet away, nightmare waves leaped and stretched into the sky.

Then there came another lull and a light appeared out in the lake. It rose and fell in the surf and in a few moments the flattened and horrified little man on the shore could see what it was. A solemn thunderclap drowned out his scream of terror.

Shouting wordless things, he stumbled swaying to his feet and clawed through the bushes to fall out onto the road. It saw him! He was sure it saw him. He struggled along on his knees in the sand for a short distance before he fell for the last time.

The wind shrilled again in the trees, but the fury of the storm had finally passed. The rain pounded steadily now on the sodden sand dunes, and dripped off the cottonwood branches

onto the quiet form of Mr. Zandbergen, who would not see the fruit boats go out again after all.

The sheriff was a conversational man. "Now I've lived on the lake for forty years," he said to Thorne, "but never — *never* did I see a storm like today's. No sir!" He turned to his subordinate standing beside him. "Regular typhoon, eh, Sam? I guess we won't be forgetting that one in a hurry!"

Dr. Thorne, at any rate, would not forget it. He could still hear the thunder as it had rolled away off over the dunes in the east, and see the flaring white cones of his headlights cutting out his way through the rain. He had gone slowly over the sliding wet sand of the wagon road on the way home, but even at that he had almost missed seeing it. He remembered how he had thought it was a fallen branch at first, and how he had got out of the car and stood there in the rain looking at it before he had wrapped his slicker around it and driven back to town.

And now the rain had stopped at last, and the office of the Port Grand physician who was the county medical examiner was neat, dim, and stuffy with the smell of pharmaceuticals and wet raincoats. Over the other homely odors hung the stench of burnt flesh.

Snip, went the physician's bandage shears through charred cloth. Thorne lit a cigarette and inhaled,

but the sharp, sickening other smell remained in his nostrils.

"According to his Seamen's International card, he was George Zandbergen of Port Grand," said the sheriff to Sam, who carefully transcribed this information in his notebook. To Thorne he said, "Did you know him, mister?"

Thorne shook his head.

"I remember him, Peter," said the physician, experimentally determining the stiffness of the dead fingers before him. "Appendicitis in 1946. Left town after that. I think he used to be an oiler on the *Josephine Temple* in the fruit fleet. I'll have a file on him around somewhere."

"Get that, Sam," said the sheriff. He turned to Thorne, standing awkwardly at the foot of the examination table. "We'll have to have your story for the record, of course. I hope this won't take too long. Start at the beginning, please."

Gulping down his nervousness and revulsion, Thorne told of returning from town about nine o'clock and finding the corpse of a man lying in the middle of a deserted side road. Dr. Thorne recalled his puzzling at the condition of the body, for although it had been storming heavily at the time, portions of the body had been burnt quite black. Thorne had found something at the scene also, but failing to see that it had any connection with the matters at hand, prudently kept his discovery to himself. The sheriff

would hardly be interested in it, he told himself, but nevertheless he hoped that the bulge it made in his pocket wasn't too noticeable.

Officer Sam Sterns made the last little tipped-v that stood for a period in his transcription and looked nervously about him. His chief peered approvingly — even if uncomprehendingly — at the notes and then said:

"How does it look, doctor?"

"I—" Thorne began, and then cursed silently in embarrassment when he realized that he had not been spoken to.

"Third degree burns on fifty per cent of the body area, seared to the bone in some parts of the face and about the right scapula. How did you say he was lying when you found him, Mr. Thorne?"

"In an unnatural kind of sprawled position, on the right side."

The physician yawned, rummaged in a cabinet and produced a sheet with which he covered the charred body. "Pretty obvious, Peter, with these burns and all. Verdict is accidental death. The poor devil was struck by lightning. Time of death was about eight p.m." He tucked the sheet securely around the head. "That lightning's pretty odd stuff, now. Can blow the soles off a man's shoes without scratching him or generate enough heat to melt metal. You never know what tricks it's going to play. Take this guy here: one side of him's broiled

black and the other's not even singed. Well, you never know, do you?"

He picked up his phone and conversed briefly with the local undertaking parlor. And when negotiations for the disposition of the unfortunate Mr. Zandbergen had been completed, he replaced the receiver and shuffled toward the door. Thorne could see that he had bedroom slippers on under his rubbers.

"You can finish up tomorrow, Peter," he resumed. "My wife was kinda peeved at me coming out this way! You know how women are. Good night to you, Mr. Thorne. I think there's an old overcoat in that closet I could let you have. You'll be wanting to send yours to the cleaners."

There was a genial guffaw from the sheriff. "We won't keep you any longer tonight, Mr. Thorne. Just let me know how I can get in touch with you."

"Through Kirk MacInnes on River Road," said Thorne. "He'll be glad to contact me through his amateur station." He edged through the door into the quiet night. The sheriff came close behind.

"So you're a ham, eh?" he said warmly. "Well, can you tie that! I used to have a ticket myself in the old days."

Polite noises. How about that? Kindred souls. Sorry about all this sloppy business, old man. Tough luck you had to be the one to find him. Really nothing, old man. *Why* didn't that cop stop talking? The weight in Thorne's

pocket seemed to grow.

"You know, I'll be dropping in to see your rig some one of these days if you don't mind. I'll bet you could use a little company out there in the dunes, eh?"

No, why should he mind. Delighted, old man. Any time at all.

The thing in his pocket seemed to sag to his ankles. It would rip the pocket and fall out. And it had bits of charred cloth on it. Why didn't they go? They couldn't possibly suspect that he hadn't—

Oh yes, he was on ten meters. Phone. Oh, the sheriff had done c.w. on 180? Well, wasn't that nice.

They walked to the cars under the big old elm trees that lined the comfortable street. A few stars came out, and down where the street dead-ended into the river, they could see lights moving toward the deepwater channel that connected the river with the lake.

"Well, good night, sheriff," Thorne said. "Good night, Sterns. Hope next time we'll meet under more pleasant circumstances."

"Good night, Mr. Thorne," said Sam, who was thoroughly bored with talk that he didn't understand, and anxious to get home to his wife and baby. So an old tramp got himself struck by lightning. So what?

Hadn't little Sam almost said "Daddy" for him at supper?

The police got into their car and drove off. Thorne sat quietly behind

the wheel of the jeep until he was sure they were gone, then gingerly removed the weight from his pocket and unwrapped the handkerchief that covered it.

This one was the size of his closed fist and irregular in shape. He had found it flattened under the black char that had once been a man's shoulder, glowing with a bright yellow light in its heart. It looked the same as the three small drops he had previously seen, but he saw that what he had mistaken for golden flecks inside of it was really a fine network of metallic threads which formed a web apparently imbedded a few centimeters below the thing's surface.

There was something funny about it, all right.

Around him, the lights of the quiet houses were going out one by one. It was eleven o'clock. A few wet patches still glistened on the street under the lamps and a boat motor on the river pulsed, then stilled.

Thorne looked around him quickly, then got out of the car and laid the thing on the curb. The wet leaves in the gutter below it reflected yellow faintly.

It was funny that the mere matter of shape could change his feelings toward it so radically. The smaller drops had been rather beautiful in their droplike symmetry, but this one, although it was made of the same wonderful stuff, had none of the beauty. The irregular cavity in its side

that would fit a human shoulder blade made it a thing sinister; the dried blood and ashes made it monstrous.

He took a tire iron out of the tool kit and tapped the glowing thing experimentally. It was certainly stronger than it looked, at any rate. When harder taps failed to crack it, he raised the iron and brought it down with all his strength. The tool bounced, skidded, and chipped the concrete curbstone, but the thing flew undamaged into the gutter.

Thorne bent down and poked it incredulously. And suddenly, with a cry of agony, he dropped the tire iron. It was hot! The tool arced down and lay sizzling sullenly among the little drops of water that still clung to the grass blades. His hand — He clenched his teeth to keep from crying out again. The skin of the palm had adhered to the hot metal and ripped off.

But the glowing thing in the gutter was not hot. Steam rose from the iron in the grass, but the little rivulets bathing the glowing thing were cool. He seemed to remember something, but then the shocked numbness coming over his hand took his attention and he forgot it again. His hand. A dull throbbing rose up his arm and he glared vengefully at the golden object that he felt must somehow be responsible for the pain.

Down among the leaves and trash, the thing that was not shattered by the strength of Dr. Thorne grew, momentarily, more golden; and with a

deliberate, liquid ripple the ugly bulges on its surface smoothed and it assumed the perfect drop shape of its predecessors.

200000 AU PLUS PLENTY WATTS.
TELL ME PRETTY MAIDEN ARE
THERE ANY MORE AT HOME
LIKE YOU? ARRIVE NOON
THURSDAY. LOVE. SEPPEL.

"You think you're pretty smart, don't you," said Thorne.

"Yep," said Willy Seppel smugly, smirking around the edge of his beer. He put down the glass and the smirk expanded to a grin. "Smart enough to see what those drops were that you sent me for a gag. That was a great little trick of yours, you know. I was all set to throw them out after reading that note of yours. The only thing that saved them was Archie Deck. He thought they might be Prince Rupert drops and tried to crack the tails off with a file."

"Aha," said Dr. Thorne.

Seppel looked at him with bright blue, innocent eyes. He was a large, elegantly dressed man with an eagle-beak nose and a crown of fine, blond hair.

"You don't have to look at me like that," said Thorne. "I've been able to find out a little bit more about them myself."

"Tell me," said the pink face complacently.

"They generate heat. And I found

it out the same way Archie probably did. Only I found out the hard way." He swept up the empty glasses and beer bottles with a crash and disappeared into the kitchen. His voice continued distantly:

"I found those two I sent you inside the stomach of a toad. Or at least what was left of the stomach of a toad. Look in the lab room, the big shelf; second bottle from the end on the right-hand side."

Wiping his hands on his trousers, he returned to Seppel, who stood looking thoughtfully into the toad's bottle. "It ate the drops," Thorne said shortly.

"Mm . . . yes, that explains it," he mused. "The digestive juices might very possibly be able to—"

"Come on, Willy. What is it?"

"You were almost right when you said it generated heat," Willy said. "I brought one of them here to show you." He left the room and returned in a minute with a large cowhide brief case.

"This thing's in a couple of pieces," Seppel apologized. "You'll have to wait until I set it up. Have you got a step-down transformer?"

Thorne nodded and fetched it from the bookcase.

"Now this little drop here may look like a bead, but it has some very singular properties." He removed the thing from a box which had been heavily sealed and padded, and set it

in a nest of gray, woolly stuff in the middle of the table.

"It gives off long infrared, mostly stacked up around two hundred thousand angstroms. But their energy is way out of proportion from what you'd expect from the equation. This little gadget is something Deck and I rigged up to measure it crudely. Essentially, it's a TC130X couple that can detect a heartburn in the next county hooked up to a spring gun. You put the drop in here, regulate the tension of the spring, and firing the gun releases this rod which delivers the drop an appropriate smack." His pink fingers with their immaculately groomed nails worked deftly. "We don't get a true controlled measurement, of course, but it'll show you what I mean. Where do you hide your outlets?"

"Behind the fish tank. Be careful not to disconnect the aerator."

"The indicator on that end will show you the energy output. Watch now."

The line on the gray screengraph bucked at the firing of the spring then angled up sharply.

"Mad, isn't it?" remarked Dr. Thorne. "Hit it again, but lower the tension of the spring."

If anything, the trace shot even higher.

"We've tried to find a relationship between the force of the smack and the energy output," said Seppel, "but it just isn't proportional. Sometimes

a little nudge will set it off like a rocket. And again, after we tapped it for a week figuring out what it was, it showed a tendency to sulk after a while and wouldn't perform at all!"

He was trying to control himself. But the ecstasy of excitement had brought bright drops out on his forehead. The cabochon sapphires in his heavy gold cuff links flashed with every gesture he made, and Willy Seppel's eyes shone with a blue that was scarcely less bright.

"The energy output," Thorne said. "It's really quite small, isn't it?"

"Yes, but still surprising for an object this size." He removed the drop from the device and put it back into its little box. "We think that glowing heart has something to do with it. And those gold threads—they are gold, you know—come in there, too. Old Camestres, the Medalist himself, was visiting the university, and he says that glow is something that'll have the physicists crawling the walls."

"Oh, come now," said Dr. Thorne broadly.

"You just wait," said Seppel. "We haven't done the analysis yet, but we expect great things. The glow," he added, "isn't hard radiation, if that's what you're thinking."

Willy was proud of it, Thorne thought. It was really his discovery, after all, not Thorne's, and Willy, who found challenge and stimulation in the oddest places, had hit the heights

with the little golden things.

But Thorne was remembering a larger drop, the size of a man's fist, and the charred body of a dead man.

"I found another specimen," he said, turning to a drawer in the work-table. "A larger one." He took out Mr. Zandbergen's drop.

"This is wonderful!" Seppel cried. "It's almost the size of a grapefruit! Now we can—"

Thorne cut him off gently. "I want to tell you about this one. Then I'll turn it over to you. When I first found it, it was irregularly shaped. Lumpy. Ugly. It's smooth now, just like the others, but it changed right before my eyes. It just seemed to run fluid, then coalesce again into the drop shape. And there's something else."

He told Seppel about the attempt to crack the thing and the abrupt heating of the tire iron.

"Yes, that could be," Seppel decided. "It's easily possible that a larger specimen such as this one here could cause a metal object near it to become perceptibly warm. Infrared rays aren't hot in themselves, but when they penetrate a material their wave-length is increased and the energy released heats the material. In the case of the tire iron, the conductivity of the metal was greater than that of your hand, and you felt the warm iron before the skin itself was affected."

"The iron wasn't warm, Willy. It

was red-hot. And in a matter of seconds. It took the skin off my hand before I could drop it."

Seppel shook his head. "I don't know what to say. If it should happen that the drop really did burn you, we've got something more here than an unusual mineral."

"The dead man who lay down on it didn't think it was a toy," said Thorne.

"You don't think this little thing killed him, do you? I read about that case. Man was charred to a cinder all along one side of him. Do you know what kind of infrared could do a thing like that? None."

"I didn't say I thought *this* one killed him," said Thorne, with a cue that Seppel chose to ignore. "I just said the body was right on top if it."

"It's too wild for me," said Seppel. He got up, stretched leisurely, and glanced at the clock. "And anyhow, it's sack time now. We can worry about it tomorrow, eh?"

Thorne smiled. Good old Willy. No little glowing monster was going to keep *him* from his sleep.

"We'll put grapefruit back in the drawer," the pink man suggested, "have ourselves a snack, and go to bed."

"Wouldn't the big one be better off in a pail of ice?" said Thorne, half laughingly.

"If it did decide to give out, it would probably melt the pail before it melted the ice. And besides," he added with dapper complacency,

"they never radiate unless they're disturbed."

In the dream, there was sand all around him. He was in it, buried up to his neck. There was a sun overhead that was transparent and gold-limned and a wind that never seemed to reach his feverish face threw up little whirls of yellow sand.

Sometimes there was a person who looked out of the sun, and her hair was gold and streaming like the sand. He cried her name and she was gone.

And after that, he forgot her, for small, shapeless things gamboled out on the sand into the sun, only to be burnt black as the rays struck them—

For the fifth time that night, it seemed, Thorne awoke, his eyes staring widely into the darkness. He cursed thickly at himself and turned the perspiration-soaked pillow over, pommeling it into a semblance of plumpness. Seppel lay beside him, snoring gently, his yellow hair gleaming in the moonlight that sieved softly through the evergreen branches.

Somewhere in the lodge a timber creaked, and he felt the fear come back again, and saw the black, huddled heap lying before his headlights, and felt the pain renewed in his slow-healing hand. Of the dream, strangely, there was no memory at all.

Only the fear.

But why should he be afraid? There was nothing out there. Nothing out there at all.



But the heap in the road. Lightning. But the little one had burned. So what? The little one was too small to burn a man seriously. I know that. He was burned. Lightning, you silly fool! He was burned! Shut up. One of them burned him. Shut up! Shut up! There's another one out there tonight.

No. Nothing out there at all.

Nothing but the dunes and the lake. Nothing.

The wind squalls strummed the pine branches out there, and swirls of sand borne up the bluff from the beach below tickled faintly at the window. The waves of Michigan were roaring out there—but there was nothing else.

Finally, he was able to sleep.

It must have been near dawn when he woke again, but this time he was on guard and alert as he lowered his bare feet softly to the floor. His hand

closed over the barrel of a flashlight on the chest of drawers, and he moved noiselessly so that he would not wake the sleeper beside him.

He tiptoed slowly through the workroom and the living room. Something was on the porch.

As he came through the doors, he said sharply: "Who's there?"

An odor of burnt wood hit his nostrils. He exclaimed shortly under his breath and shone the light down near the sill of the outside door. There was a neat, round hole in the door, smoking and glowing faintly around the edges.

He raced back into the workroom and pulled out the drawer that had held the grapefruit-sized drop. It was empty, and a round hole gaped in the bottom of it. The hardwood was still burning slowly.

He yanked out the drawer, put it in the kitchen sink, and turned on the water. Then he filled a pan and soaked the hole in the door thoroughly.

They never radiate unless they're disturbed! That was a laugh. Not only had it radiated, but it had somehow focused the radiation. And even the feeble physics of Dr. Thorne began to wonder if the meter had told the whole story of the little glowing drop.

He unlocked the door and slid out into the night. Below the stair was a small, almost imperceptible track in the sand. He followed it down the ridge of the dune, lost it momentarily in a patch of scrub, then found it

again in the undisturbed expanse of the sand blow.

He went down into the silent valley, the bobbing yellow light from his flash throwing the tiny track into high relief. When he reached the center of the bowl, he stopped among the long shadows of the gaunt, spiky trees.

There was another track in the sand, meeting and merging with the little one. And the track was three feet wide.

He followed it as if in a dream to the crest of the first low shore dune and stood on its summit among the sharp grass and wild grape. The moon's crescent was low over the water and orange. He saw the track go down the slope and disappear into the waves which laved the sand gently and swirled in a new depression in the shore.

The wind whipped his pajama shirt about his back as he stood there and knew that he was afraid of that track in the sand, and that it hadn't been lightning after all.

It was not until he had locked the door of the lodge behind him that he realized he had run all of the way back.

Friday was a relatively quiet day in the dune country, but the police did receive three minor complaints. A farmer charged that someone had not only made off with and eaten three of his best laying hens, but had burnt the feathers and bones and left them right in the chicken yard; the Ottawa County Highway Commission wanted

to know who was building fires in the middle of their asphalt roads and plastering the landscape with hot tar; and a maiden lady complained that the artists in the local summer colony must be holding wild orgies again from the looks of the lights she had seen over there at 3:00 a.m.

Dr. Thorne bent down over the tracks in the sand. Yes, it certainly looked as if the big one had been waiting for Mr. Zandbergen's drop.

Seppel said: "Get out of the way there," and snapped his camera. "These sand tracks won't last long in the winds around here. And I frankly tell you that if I hadn't seen it with my own eyes, I would never have believed it." He circled the point of conjunction, laid his fountain pen beside it for size reference, and the camera flashed again.

"We'll want the door, too," the pink man said, putting the camera aside and scrawling in his notebook. Thorne howled.

"Well, just the part with the hole in it then," Seppel conceded. "Did you find out where the large track came from?"

"I tracked it to the woods. The ground there is too soft and boggy to hold a wide track like that, and I finally lost it."

Seppel struggled to his feet and retrieved his coat, which he had hung on the white peg branch of a skeleton tree. "Just imagine the size of an ob-

ject that would make a three-foot track in soft sand!" he exclaimed. "And to think it's been in the lake for who knows how long, and this is the first time it's come into evidence!"

"I wouldn't be too sure about that," said Thorne. "There have been some funny old stories told along these shores. I heard one myself from my grandmother when I was about twelve. About the Dune Roller that was bigger than a schooner and lived in the caves at the bottom of the lake. It came out every hundred years and rolled through the dune forest, leaving a strip of bare sand behind it where it had eaten the vegetation. They said it looked for a man, and when it found one, it would stop rolling and sink back into the lake."

"Great Caesar," said Seppel solemnly. "I can see it now—the great glowing globe lurking deep in those caverns where the sun never shines and there is no life except a few diatoms drifting in the motionless waters."

Thorne gaped at his friend for a minute, and then spied a suspicious twinkle in one blue eye.

"This is no laughing matter, you Sunday Supplementist," he said sharply.

"Hm-m-m," said Willy Seppel irreverently, and brushed a few grains of sand from his handsome suit.

It was late when Miss Jeanne Wright got out of the movie in Mus-

kegon—so late that she barely had time to do the shopping which had, ostensibly, been her reason for taking the *Carlin* out. "You just can't buy decent dresses in Port Grand, Uncle Kirk," she had pleaded prettily, and he really wouldn't mind if she took the boat, would he? MacInnes had growled indulgently from the depths of his new panadaptor and said he certainly did, confound it, and what was the matter with using the car? But he had tossed her the keys just the same.

The streetlights of the city were going on when, laden with bundles, she finally hailed a cab and drove to the yacht basin. It was a beautiful evening, with soft-glowing stars in a sky that was still deep purple out over the water. The *Carlin* slipped majestically out among the anchored craft into Muskegon Lake.

A bonfire blazed cheerfully on the shore and singing voices from some beach party floated melodiously out over the water. They shouted a jocular greeting to the *Carlin* and Jeanne blew a good-natured hail to them with the air horn. Her heart was light as she led the cruiser through the channel into the lake and headed for home.

A secretive smile danced on her lips, and she thought warm and tender things about a certain stern-faced young biologist. He was a strange man, occasionally even rude in an unintentional sort of way, and preoccupied with such dreary things as

plant cycles and environmental adaptations. But he had walked with her in the dunes one day and changed for a little while, and kissed her once, very gently, on the lips. And after that she had known what she wanted.

He would be sitting in his workroom now, looking over the day's bugs and not thinking of her at all. Or perhaps he would be talking with her uncle over the radio.

"Ian, Ian," she hummed dreamily. The cruiser's speed increased to twenty and she rocked momentarily in a trough and set the little good luck charm hung up over the wheel to bobbing like a pendulum. Ian had given that to her. She loved it because of that.

Then after a while she turned on the short-wave receiver that sat on one of the lockers in the deckhouse and listened to Ian and her uncle.

"I have a colleague of mine out from Ann Arbor," Thorne was saying. "About that amber drop we found. Remember my telling you about it? I gave one to Jeanne for a souvenir. My friend is a biophysicist and thinks the drops are a great scientific discovery. His name is Willy Seppel. Say something, Willy."

"Gambusia," said Seppel, recalling the minnows in the larvae pail.

Jeanne listened absently. Ian was telling how the drops gave off hot light when they were disturbed. How he thought there might be bigger drops around that could really grind

out the energy 40db. above S9. (What in the world did *that* mean?) Thorne and this Willy person would look for the bigger drops.

"Is it really hot?" Jeanne wondered, staring curiously at the pendant drop. It didn't seem to be. But then Ian had said the little ones didn't radiate very much. Only enough to tickle a something-or-other.

Far out in the lake, the lights of an ore boat twinkled. She passed the little village of Lake Harbor and put out a bit farther from shore. There would be no more towns now until Port Grand.

Over the radio, her Uncle Kirk's voice, homely and kind, was describing the great things in store for the new panadaptor. Ian would put in a comment here and there, but she noticed that he sounded tired, poor darling.

Cleanly, powerfully, the *Carlin* sliced through the waves, pursuing the shadow of herself. The shadow was long, and very black. A boat with a searchlight, thought Jeanne, and looked astern.

Normally, Miss Wright was a thoroughly keen, competent young lady. She was mistress not only of her boat, but of herself. But when she looked over her shoulder and saw what appeared to be a great, glowing globe of phosphorescence not twenty yards off her stern, a globe that was rapidly bearing down on her cruiser, she gave

vent to a scream that doubtless could have been heard on land, three miles away.

To her credit, however, when she found that the scream did not deter the thing following her, she opened the throttle and attempted to outmaneuver it. But the great glowing monster would pause while she veered and spiraled, then overtake her easily when she tried to run away. The magnificent, tortured motors of the *Matthews* throbbed in the hull beneath her feet as she tried to urge them to a speed for which they were never intended.

The thing was drawing closer. She could see trails of vapor streaming from it. What was it? What would it do if it caught her?

Bigger ones! Her eyes turned with horror to the tiny drop on its silver chain. Its glow was the perfect miniature of the monstrous thing in the water behind her. A sob caught in her throat as she wrenched the *Carlin's* wheel from side to side in hysterical frenzy. Across the cabin, the quiet voice of Ian was telling MacInnes how to rig the panadaptor as a frequency monitor.

Ian!

And if you're ever in a jam—

With tears streaming down her cheeks she set the automatic pilot and fumbled with the little amateur transmitter that had been built into the locker. She had seen her uncle use it only once. That turned it on, she

thought, but how did she know it was set right? Or did you set these things?

The little panel wore three switches, two knobs, a dial and a little red light. Naturally Kirk MacInnes had not labeled the controls of an instrument he had built himself. The panel was innocent of any such clutterment.

The *Carlin* tore through the night. The glowing thing was less than fifteen yards behind.

Jeanne wept wildly and the placid voices over the radio spoke sympathetically of the ruining of Thorne's beach pool by the storm.

Oh, those knobs and switches! This one, and then this one, she thought. No—that wasn't right. The little transmitter might not even be on the air at all, or worse still, be set for some part of the band where Ian and her uncle would fail to hear her. But what was she supposed to do? This funny tuning dial made no sense at all.

"I've got a swell mobile VFO in the *Carlin*," said MacInnes.

"What's VFO?" asked Seppel.

"In Mac's case, it means Very Frequently Offband."

Laughter.

Oh, what difference would it make? What could he do to help her? The brilliance of the huge thing was lighting up the water for yards around. Aching sobs welled from her throat. "Ian! Ian!" she screamed. "Why don't you help me?"

The calm voices floated from the

receiver and the globe drew closer than it had ever been.

She clawed at the stand-by switch and suddenly her sobs and the beat of the engines were the only sounds in the deckhouse. She would try. That was all. She would try and pray that her uncle had left the transmitter set correctly.

"Ian!" she cried, then remembered to press the button on the side of the little hand microphone. Forcing back her tears she said, "Ian, Ian—can you hear me?"

Trembling, her hand touched the receiver.

"Jeanne!" the sound burst out of the speaker. "Is that you? What are you doing?"

"It's after me, Ian!" she screamed. "A glowing sphere fifteen feet high! It's chasing the boat!"

"The boat," came MacInnes' voice numbly. "She took it to Muskegon."

"Jeanne! Listen to me. I don't know whether this will do any good, but you must try. You must do exactly as I say. Do you hear me?"

"I hear you. I . . . Ian! That thing is almost on top of the boat!"

"Listen. Listen to me, darling. You have that little amber drop somewhere in the boat. Do you remember? That little amber drop I gave you. Get it. Take it and throw it overboard. Throw it as far as you can. The amber drop! Now tell me if you heard me. Over."

"Yes. I hear you. The drop—"

The drop. It danced on its little silver chain and the light in its core was bright and pulsating and warm. She tore it from its place over the wheel and groped back to the open cockpit of the cruiser. She clung for a full minute to the canopy stanchion, blinded by the golden light.

And then the small drop arced brightly over the water, even as a meteor had, many centuries past.

The light, reflecting off the walls painted a flat, clinical white, was full of blurred, fuzzy forms. They might have been almost anything, Thorne thought. And he shuddered as he thought of what they might have been. A table, for instance, with a burden that was sprawled and made black all along one side.

Without moving his head or changing his expression he squeezed his eyes shut very slowly and opened them again. But it was not the medical examiner's office. It was the waiting room of the little local hospital and Willy Seppel was sitting beside him on the leather couch. Through the open window behind the lowered blinds, a clovery night breeze stirred, parting the smoke that filled the room and turning a page of the magazine that Seppel was staring at.

A young man of twenty-five or so sat across the room from them and ate prodigious quantities of lifesavers. "My wife," he had grinned nervously at them. "Our first."

The persons in the waiting room could see through the open door of the waiting room to a room at the end of the hall. People in white would periodically enter and leave this room, but another, grimmer group which had entered nearly an hour ago had not come out.

"Willy, I'm going nuts," he burst out at last. "What are they doing in there? You'd think they'd at least let me know—let me see her."

"Easy. It'll be any minute now." He proffered a gold cigarette case, but Thorne shook his head. "Why don't you lie back and try to relax?" Seppel said. "You've been crouching there staring at the floor until your eyes look like a pair of burned out bulbs. What good do you think you're going to do her in that kind of shape?"

Thorne sank back and lay with the back of his hand shading his eyes. If only he could have been there when they brought her in! But it takes time to find where an unmanned boat has drifted. Time while he sat before his receiver with nothing to do but wait. The hands of the clock had wound around to 1:00 a.m. before the call finally came and he knew she was saved.

It was 3:30 now. MacInnes and his wife were in there with her. He looked despairingly down the white corridor. Why didn't someone come out and tell him?

The sound of her voice, made broken and breathless with weeping,

haunted him. She had said the thing was fifteen feet high. The big one itself. And it could have—

This wouldn't do at all. The memory of his dream the previous night stood out in his mind with horrible clarity. The bright golden sun and the little burned things. But infrared doesn't burn. The bright golden sun.

"Sun," said Dr. Thorne to himself, very quietly.

"Hm-m-m?" said Seppel.

"Sun," he repeated firmly. "Willy, do you always think the same way?" "Nope."

"If I hit you, how do you think?"

"Mad," said Seppel, with a winning smile.

"But if you figure the best way to sneak out of here without being seen, how do you think?"

"Rationally."

"I've been thinking about the drops again. You know, we've got a pretty serious discrepancy in the so-called properties of the things. We've proved the infrared emission, but infrared doesn't sear flesh."

"That's what I've been trying to tell you."

"None the less, I'm convinced that the big one Jeanne saw is the thing that did for the tramp. Now what if the energy emitted is not always infrared. What if the infrared is a sort of involuntary result of the blows we gave the drop, while ordinarily when it's aroused it gives off another wave-

length. Say, something in the visible, like sunlight. Something with a lot of energy, that that drop shape could focus into a beam."

Seppel didn't say a thing.

Silence precipitated heavily. The young man in the chair opposite them shifted his position and stared at them with gaping awe! Scientists!

There was a starchy swish and a nurse appeared in the doorway.

Thorne started to his feet. "Can we—"

"Mr. De Angelo," she beckoned coolly. "It's a boy. Will you follow me, please?"

The young man gave a joyous, inarticulate cry and rushed out of the room.

Thorne dropped back. "Ye gods," he muttered.

"You've really got it bad, haven't you," Seppel marveled.

"Oh, Willy, shut up. You know I'm only interested in her because of the thing that chased her. It's a perfectly objective, academic interest. And I wish you'd wipe that look off your face. Between you and MacInnes a man doesn't have a chance."

The pink face looked slightly hurt.

"I'm sorry," Thorne apologized briefly. He walked around the room. The young man with the new son had been so anxious to leave that he had forgotten his lifesavers. Thorne ate one. It was wintergreen. He hated wintergreen.

Seppel yawned delicately, then

leaned forward and glanced out the door. "Someone's coming," he warned softly.

A tall man in a uniform of summer tans had left the room at the end of the corridor and walked purposefully toward the waiting room.

Seppel rose to his feet as the man entered the room. He said, "Good evening . . . or rather, good morning, sir. Is there something I can do?"

"My name is Cunningham, commander of the Coast Guard cutter *Manistique*. Are you Dr. Ian Thorne?"

"My name is Seppel. This is Dr. Thorne. Won't you sit down, commander?"

"Thanks, I will." To Thorne, who stood with his hands rudely clasped behind his back, he said briskly: "Dr. Thorne, at nine this evening your amateur station contacted our base with information that the cruiser *Carlin* was in difficulty off the mainland somewhere between Port Grand and Muskegon."

"It wasn't me, it was Kirk MacInnes." Thorne was not interested in brisk, nautical gentlemen.

"We found the cruiser drifting, out of gas, some seven miles off the Port Grand light. Miss Wright, the operator of the craft, was found lying unconscious on the cockpit floor. I've just seen her—"

"How is she?" Thorne cut in suddenly.

"The doctor says she is suffering

from shock, but other than that, he can't find a thing wrong with her. Now what I'd like to know—"

"Is she conscious? Has she been able to talk?"

"She's very weak, and what she says makes no sense. I thought perhaps you might be able to help us on that score."

Thorne looked at the man narrowly. "We were conversing with her on the radio, when she suddenly seemed to become disturbed and evidently fainted."

"Did MacInnes tell you anything?" asked Seppel.

"No."

"Quiet, Willy," Thorne said.

"She seemed to be trying to tell us that someone was chasing her," Cunningham persisted. "Are you sure she said nothing in her talk with you that could give us a hint of the trouble?"

"I knew there was something wrong from the sound of her voice. That's all. When she didn't answer, Mr. MacInnes radioed the Coast Guard."

"And we found her after a four-hour search. That young lady was very lucky that she ran out of gas. Her automatic pilot had the cruiser headed straight out into the middle of the lake."

"There was . . . nothing else on the water near her?"

"The lake was empty." Cunningham paused, then said casually, "Was there something you expected us to find, Dr. Thorne?"

"Certainly not. I was just wondering."

"I see." The officer got to his feet. "I don't mind telling you gentlemen that I think there's something you're not letting me know. My job is done, and it's true that legally I have no business questioning you at all. But my business is keeping the waterways safe. That young lady in the room down the hall didn't faint from nervous exhaustion or hunger. Something scared her out there on the lake. If you know what it was, I wish you'd tell me!"

"Have you ever read any science fiction, Commander Cunningham?" Seppel asked, toying with his gold cigarette case. Rather belatedly, he said, "Cigarette?"

The guardsman took one with suspicious thanks. "Are you trying to tell me that the little green Martians have put outboards on their rocketships and are chasing the pleasure craft on our lake?"

Thorne said harshly: "What Dr. Seppel means is this: We have reason to believe that a highly unusual occurrence was responsible for tonight's unpleasantness. I don't like to mince words, commander. I think I *do* know what was out there tonight, but I can't even begin to prove it. I also have a rather intense aversion to being laughed at."

"I have no intention of laughing, Dr. Thorne. But if you have informa-

tion relative to marine safety, let me remind you that you have an obligation to report it to the proper authorities."

"Proper authorities are not notorious for their sympathy. They'd laugh in my face!"

"Are you trying to make a fool out of me?" said Cunningham wrathfully. "Because if you are—"

"Gentlemen," said Seppel mildly. Perhaps it was fortunate that at that moment Kirk MacInnes and his wife hurried into the room.

"She wants to see you, son," the Scotchman said tiredly. "She's a little stronger now and she asked for you. I'm taking Ellen back home. This has been pretty raw for her."

"I'm all right," his wife said stiffly. She clutched a damp, tightly-balled lace handkerchief, but her features were immobile.

"Will Jeanne be all right?" Thorne asked brokenly.

"She'll be fine," said MacInnes, clapping him on the back. "Now get down there and see her before those medics decide she can't have any more visitors."

"I'm there now. And—thanks, Mac." He disappeared down the corridor. The engineer and his wife left quietly.

"Thorne is a good man," Seppel said, "even if he is a trifle mule-headed." His bright blue eyes looked humorously into the still half-angry face of the Coast Guard officer. He

laughed, moved over on the leather couch, and said, "Sit down here, commander. Have another cigarette. Have a lifesaver. I'm going to tell you a very singular story."

During the days that followed, Dr. Thorne went about his work with quiet preoccupation; and this in itself was enough to make Seppel more than a little suspicious. He rarely mentioned the drops, although he visited Jeanne every day, lugging great preposterous sheaves of flowers and boxes of candy and fruit. Seppel went along on these pilgrimages for the ride, but almost always tactfully declined visiting the sickroom and hiked out instead to the Coast Guard station for a parley with his new ally, Commander Cunningham.

Anxiety furrowed Seppel's pink forehead as he paced up and down the officer's quarters. "He's got something up his sleeve," he maintained. "He goes off in the jeep in the morning and doesn't come back until noon. When I ask him where he's been, he says he just went into town to see Jeanne. But visiting hours are from two to four! If he doesn't go to the hospital, where does he go?"

Cunningham shrugged, and picked up a folded newspaper that lay on the table. "Have you seen this, Willy? It might explain a few things."

Mystified, Seppel read aloud: "We pay CASH for certain unusual minerals. Highest prices, free pickup.



Samples wanted are round, semitransparent, amber colored with metallic veining. HURRY! Write today, Box 236, Port Grand, Michigan, or call 651.' Why, that's MacInnes' phone."

The bright blue eyes stared aghast.

"I take it you weren't acquainted with this," the officer said. He walked to the window and looked down at a fruiter steaming through the channel. "Do you know what he plans to do?"

"I know what I'd do. There's some kind of an attraction between the big globe and the drops—a force that draws the little ones home to mama when they get her call. We found that out with a drop at Thorne's lodge. But that attraction is so great that it works the other way, too. Little Miss Wright told you that. If the drops can't come, if we hold them back, mama comes after her children. That's what Thorne will probably count on."

It was Cunningham's turn to stare. "You mean he'll use the drops from the ad for *bait*?"

Seppel said gently: "What's a man to do, Rob? He can't let it go free. The fellow that finds the monster has three choices: he can run home and hide under the bed, and pretend he didn't see it at all; he can try to inform the proper authorities; or he can try to dispose of the monster himself. Thorne knows nobody will believe his dune roller story so he just doesn't waste time convincing people."

Commander Cunningham turned abruptly from the window and said violently: "You aren't going to start on me too, are you, Willy? Sure. Here I am, one slightly used but still serviceable authority. I believe your dune roller yarn for some reason or another. But it doesn't do any good. I'd earn the biggest haw-haw from here to the Straits of Mackinac if I tried to initiate an official search for a round glowing thing fifteen feet high. The world won't unite just because Michigan has itself a monster, you know. And what can I do, even if I take the *Manistique* out? Maybe Ian Thorne knows how to catch monsters, but I certainly don't."

"You want to let him go on, I suppose," Seppel said. "The third choice of the fellow who finds the monster." He added, a trifle wistfully, "I'd hate to see him get his hide fried off when he's just beginning to think about settling down."

"You watch him. That's all. And let us know when you think something's in the wind. I'll do everything

I can." He glanced at his watch. "I have to get out of here now, Willy. Just let me know if you find out what his plans are."

"And that," said Seppel, the dark sound of doubt shading his pleasant voice, "seems to be all there is to say."

The drops glowed on the kitchen table. "Seven!" said Ian Thorne triumphantly. "How do they look to you, Willy? From the size of a pea to a tennis ball. Seven little devil eyes."

"What are you going to do with them?" asked Seppel. He wore an old lab apron over his beautiful trousers and wiped the breakfast dishes. It was very early in the morning.

"Just a little experiment. I got a bright idea the other day while I was visiting Jeanne. You can have the drops after I'm finished if you like, but I do want to try this thing out."

"I wish you'd let me help you," said Seppel quietly.

"No, Willy."

"Cunningham believes you, too," he went on recklessly. "Why don't you tell us what you're going to do?"

"No." He scooped the drops into a bakelite box. "I'll be gone most of the day. I have some collecting to do out in the dunes." He vanished into the bedroom and came out wearing hiking boots and a heavy leather jacket. An empty knapsack dangled over his arm. He put the box into the buckled pouch on the outside of the sack, and took a paper packet on

the sink and stuffed it into his back pocket.

"*Oops!* Almost forgot my collecting bottles," he laughed, and went into the radio room.

Seppel put down the dish and towel and stepped softly after him. There were no collecting bottles in the radio room. He was just in time to see Thorne drop a handful of little metal cylinders and a black, six-inch gadget into the knapsack.

Thorne did not seem at all abashed to find Seppel standing there. He offered no explanation as he brushed past the astounded pink man, but turned at the kitchen door and said:

"So long, Willy. Keep the home fires burning. Send out the posse if I'm not back before dark." The screen door slammed.

After waiting a minute, Seppel grabbed up the binoculars that always sat on the china shelf and glided silently through the sandy yard, past the generator building to the path that led down the side of the dune to the jeep's shed.

The early morning mist still curled around the trees and settled in the hollows, and a distant bird call echoed down on the forest floor. At a bend in the steep path, Seppel caught a glimpse of Thorne's broad back dappled by the pale sun rising through the fog.

The path turned sharply and cut off diagonally down the dune toward the shed. Instead of continuing on, Seppel stepped off the path, and

treading cautiously, circled across through the woods to arrive at a point on the slope directly above the garage. Then he removed his apron, spread it on the twiggy, dew-wet ground, and stretched out among the bushes, bringing his binoculars to bear on the man below.

Thorne removed a small wooden crate from the rear of the jeep. It bore the red-stenciled inscription:

G. B. VAN DER VREES & SONS
— HIGHWAY CONSTRUCTION.

There were other words too, but Thorne stood in the way. He quickly transferred the contents of the crate to his knapsack, and with a single look around him, set off down the dune trail that ran through the forest parallel to the lake shore.

As soon as Thorne was out of sight, Willy Seppel scrambled heavily to his feet and went briskly back up the path to the lodge. There he addressed some intense words to the microphone of the amateur station, an operation which would have been frowned upon by the FCC, which discourages the use of such equipment by unlicensed persons.

Although he would have maintained his disinterest and scientific detachment if he had been asked about it, the truth was that Dr. Ian Thorne deeply loved the dunes. He had lived in them during his childhood, grown up and gone away, and come back to find them substantially the same. He

recalled that had surprised him a little. You expected the dunes to change; they were like a person, though only one who has known the heights and swamps of them can explain the curious sleeping vitality of the sands that lie under the forest. Things with a smaller life than the dunes would flutter and creep and stalk boldly through them until you might think of them as dead and tame. But Dr. Thorne had seen the traveling dunes shifting restlessly before the winds and felt a kinship with the great everlasting hills.

The path he strolled along was an old friend. He had pursued the invertebrate citizens of the forest along its meandering length, waded in the marshy inter-dunal pools which it carefully skirted, and had itched from encounters with the poison ivy that festooned the trunks and shrubs beside it.

The path wound along the shore for a good five miles—horizontally, at least. Thorne was willing to swear that it did another ten up and down.

And so he did not hurry. The knapsack was too heavy, for one thing, and the still air was warming slowly as the sun rose up through the pines and oak trees. An insect chirred sleepily in a gorge on his right, and as if at some prearranged signal, an excursion of mosquitoes bobbed out to worry the back of his neck.

The path took him through a clearing in the sand covered with patches

of dusty, green grass and scarlet Indian weed. On the lee side of a great bare dune at the edge of the clearing stood a single, short cottonwood, half buried in the sand. But the tree had grown upwards to escape the flowing sand, modifying its lower branches into roots. The tree was one of the few forms of life that defied the dunes—by growing with them—and its branches were brave and green.

Thoughtfully, Thorne passed on again into the dimmer depths of the forest.

It was nearly noon when he reached the foot of a cluster of sand dunes, the principal peak of which rose some hundred and fifty feet above the floor of the woods. It was the highest point for many miles along the shore, and its name was Mount Scott. The path circled its eastern slope and then continued on, but Thorne stepped off onto the faintly defined, spider web strewn trail leading to the summit.

The going was rough. Thornapple branches probed after his eyes, and as the ascent grew steeper, sudden shifts in the dirty sand under his feet brought him to his knees. The tree roots across the path had partially blocked the sand, forming crude natural steps in the lower reaches of the dune, but as he climbed higher the trees were left behind while the sand grew cleaner and hotter, and the wild grape, creeper and ubiquitous poison ivy became the prevalent greenery.

He was winded and perspiring when

he finally stood on the peak of the dune. He glanced briefly about him and selected a spot partially shaded by a scrub juniper as his campsite. He sat down, shucked the knapsack and his heavy jacket, and lit a cigarette.

The hills below rolled away in gentle, green waves toward the farmlands and orchards in the east and the brilliant blue lake in the west. He could see the spires of the town of Port Grand poking out of the haze a few miles down the shore, and a few white sails appeared off the promontory that hid the entrance to the river harbor.

He turned his attention to Mount Scott itself. The summit of the dune was really composed of two shallow humps, with a depression on the lakeward side, in which Thorne had made his camp. Below this, a sheer, fairly clean slope of sand swept down to the low tangle of woods which lay between him and the shore.

He looked cautiously to the knapsack and removed the seven small drops, grouping them in a circle on the white sand of the lake slope. After that, he retreated to his hollow and settled down as comfortably as he could.

The shade of the tree diminished, disappeared as the sun climbed higher, and then reappeared on the other side of the tree, leaving Thorne with the sun in his face and a monumental

thirst.

At last, at 4:00 p.m., the largest drop began to move.

It rolled slowly out of the shallow hole in the sand that cupped it and moved down the hill with great dignity. Thorne watched it roll *up* a small pile of sand that blocked its rectilinear path and disappear into the woods at the foot of the hill.

At 4:57 one of the smaller drops followed in the track of the first. It had a little trouble when it came to the pile of sand—which was one of several strung across the face of the dune—but it negotiated the obstacle at last and disappeared.

Just as the sun was beginning to redden the water, a third drop began its descent. Quietly, Thorne rose and replaced it in its hole. The faint gleam within it might have grown a bit brighter when he interfered, but perhaps it was only the reflection of the sun.

The five remaining drops were grouped in a horsehose, downward pointing, and the drop whose elopement had just been foiled reposed at the end of one prong. A few minutes later, the large drop at the other prong attempted to roll down the hill. Thorne put it back and rapped sharply on each of the others with his cigarette lighter, tamping them down further into the sand. He was strained forward alertly now, with his eyes on the strip of forest below. The sun slipped grudgingly behind the flat, livid lake

and a tang of pine washed up the slope. The drops did not move again.

With the departure of the sun, the glow in the heart of each alien thing leaped higher and higher, until the string of them were like a softly glowing corona in the sand—a strange Earth-bound constellation.

But their glow was not beauty, Thorne reminded himself. It was death.

His cigarette end made a dimmer eye in the dusk than the glow of the drops. There was still enough light to see by—the sky was red around him, and the dune forest was silent.

From the size of it, it must have been growing for hundreds of years, collecting a drop of itself here and there, from roadbeds and sand dunes and farmyards, responding to those who imprudently hindered it with the only defense it knew.

And now he was to destroy it. It had killed a man. Perhaps before this, even, men had found the drops attractive and carelessly put them in their pockets—and the dune roller sought a man. It had killed the little tramp, and almost killed Jeanne.

It did not seem strange to him at all that it should be Jeanne's face and not Rosemarie's that smiled at him. The memory of Rosemarie was a frail thing now, crumbling like a tiny tower built of wet sand on the shore.

Around him, the forest was still.

He felt like yelling at it, *Come on*

out, you! Come out and chase me like you chased her. He fingered the stud of the little black instrument in his hand. He would show it. Let it dare to come out.

Come out!

It came.

It had made no noise at all. In a fascination of horror he watched it roll to the foot of the tall dune. It vanished among the trees, but a warm yellow radiance lit the undersides of the fluttering leaves as it moved beneath them. The light blazed as it emerged from the brush and came straight toward him, rolling up the hill.

The small drops pulsed in their sandy snares and he gave each one a savage rap. As if it, too, shared the insult, the great globe flared, then subsided sullenly. But its ponderous ascent was alarmingly rapid.

There were noises now from the winding path in the forest below, and the twinkling, pinpoint lights of men. But Thorne did not hear them, nor see any light except the great one before him. He couldn't move. Sweat stood out on his face and the instinct to flee this thing dissolved into pure stark terror that folded his legs like boneless things. He half-crouched on hands and knees and stared—and stared.

The thing was closer now, nearly up to the line of sand humps that Thorne had worked so hard on. He had to get away. There was no more

time. He forced his paralyzed hands and feet to tear into the loose sand of the side of the depression and pull him up. He had to get on the other side of the hill.

In the last instant, his numbed fingers pressed the stud of the little transmitter that would activate the firing caps of the high explosive buried in the sand.

But the monster must have realized, somehow. Because he felt it, just as he flung himself out over the peak with the deep red sky around him—a searing, mounting pain that started on the inside and flooded outward. He rolled unconscious over the far side of the hill just as the five solemn detonations blasted the golden glowing globe to bits.

There were white, gauzy circles around the places where his eyes looked out. He was vaguely surprised to see six people with the eyes—three sets of two. He made the eyes blink and the six people changed into Seppel, MacInnes and Jeanne. He tried to raise an arm and was rewarded by a fierce jab of pain. The arm was thick and bandaged, like the rest of him.

The six—three—people had seen his eyes open and they moved closer to him. Jeanne sat down beside him and leaned her head close.

“I hope that’s you in there,” she said, and he was amazed to see there were tears in her eyes.

“How am I?” he managed to

mumble through the bandages.

“Medium rare,” said Seppel.

“We almost got to the top, anyway,” said MacInnes gruffly. “But you went and beat us to it.”

“Had to,” Thorne said painfully.

“Is it gone?” he asked. There were six people again and he felt very tired.

“Shivered to atoms,” said Seppel with finality. “You should see the crater in the sand. But we’ll still have small ones to study. Your ad brought in four more today. I was talking to Camestres on the phone, and he says he’s sure he can swing a nice fat research grant for us as soon as you’re able to get out of that bed—”

Thorne groaned.

“He says,” Jeanne translated firmly, “that he’s sticking to ‘Ecological Studies of the Michigan Dunes,’ Chapter VIII. No more dune rollers, thank you.”

MacInnes laughed and wagged his gray old head. “You’d better surrender, Dr. Seppel. Jeanne’s got her mind made up. And one thing about her—whatever she says, she’ll always be Wright.”

High on a dune above the lake, smoke still rose faintly from a blackened crater in the sand. Two of the grains of sand, which gleamed in the moonlight a bit more golden than the rest, tumbled down together into a sheltered hollow to begin anew the work of three hundred years.

THE END

HELL'S PAVEMENT

BY IRVING E. COX, JR.

To the individual brought up in a military culture, the heavy weapons are the final authority; the answer to all problems. But such a one is never quite able to see anything but the Big Guns . . .

Illustrated by Cartier

"Everything registers normal," Rex reported. His voice was tense and his hands were closed tight on the dials in front of him, ready to move at the first signal of emergency. He stole a quick glance at the rest of the crew, twenty-nine hand-picked men. They were all at their stations, silent, anxious, alert, waiting for the first shock of the indefinable terror.

The air shrilled with the scream of the ray machines which surrounded the ship with a mobile capsule of a negative field. The device was new. It had performed satisfactorily in laboratory experiments, but this was its first real test under actual flight conditions.

Rex looked up at the view screen, studying the electronic relief of the

planet they were approaching, an unnamed, unexplored world, long called The Enigma in the slang of the air school. No form of communication with The Enigma had ever been established, although the Empire had conquered the galaxy. Every other planet in every other sun system had been explored and, after the existing life forms had been liquidated, colonized by the Empire.

Fifty years ago the last air fleet had flown against The Enigma. It had met the fate of every previous expedition. The Communications Corps had followed the fleet until landings were made. After that contact had been lost. Not a ship in the fleet ever returned.

Almost a million men were lost, men who had been conscripted from



every planet-colony in the system. The disaster had shaken the galaxy. There was outright criticism even in the capital of the Empire, for at that time the man-power classification system had not been perfected and occasional deviationists still grew to adulthood. Two of the outer colonies had revolted and maintained their independence for almost a decade.

As a tactical policy, conquest of The Enigma had been abandoned. Numerous free-lance explorers, with exploitation patents granted by the emperor himself, had penetrated the mists of the planet since—and never returned.

The planet outlined on the screen over Rex's head was so close that

the shapes of cities and highways began to appear in the shimmering glow of electrons. Rex braced himself against the pressure of deceleration. If the beings on The Enigma had, as Empire scientists suspected, a defense mechanism which automatically destroyed every approaching spaceship, it would have to be applied at once. In another quarter hour the expedition would land. Once they were on the ground, the conquest of the planet would be a matter of simple routine, the sort of thing every A-3 cadet learned in his basic course in Politico-Administrative Psychology.

In an echoing burst of seething fuel, the ship landed. All sound died away, except for the whine of the

protective ray machines. The technicians made an experimental point-decontrol in the capsule of the negative field. There was no reaction. Morrow, acting captain of the expedition, gave the order for complete decontrol, and the shrilling machines became slowly silent.

Like the others, Rex felt the exciting surge of triumph. This was the real moment of conquest. They had breached the defenses of the unconquered planet. The rest could proceed according to textbook formula. It had been absurdly easy.

Rex snapped off his electronoscope, and turned on the direct-view screen. He saw the spreading meadow in which the ship had come to rest. It was carpeted with bright yellow flowers, shimmering in the bright light of a single sun. Distant, rolling hills were misted in a blue haze. Closer at hand were the towering buildings of a city, sharply defined in the clear air.

As a matter of course, they began to pull on their landing suits while Morrow studied an analysis of the Enigman atmosphere. It was necessary for them to be outside the ship before the curious beings that peopled the planet came to investigate the landing. Immediate personal contact was expected to do much toward establishing the necessary impression of peace and friendship.

"Gentlemen!" Morrow cried. "The atmosphere is completely sound, almost identical with our own. Why, this means . . . this

means—" Emotion choked his words. His eyes glittered as he licked his lips with pleasure.

Not a man in the crew failed to follow the golden arrow of his unspoken thought. It was Empire policy that the new planet would be theirs for a full generation, as a reward for its conquest. When the Enigman life had been liquidated, thirty men would own a world—to divide, exploit, and colonize.

Each man put aside his landing suit and armed himself with a primitive atomic gun, universally recognized as a defensive rather than offensive weapon. The Enigmans would observe that they were not foolhardy, since they came armed for self-protection; but at the same time the nature of the weapon would suggest only peaceful intentions.

Morrow gave the command. The mechanism in the air chamber hummed. Double locks slid together. The landing way slid down into the meadow.

The thirty men descended slowly, stationing themselves with calculated informality at the base of the ship, centering around Rex. It was at the moment of first contact with the natives that Rex was most important to the expedition. As a cadet, the developing attitudes of his psychological pattern had placed him in the school of galactic communication, with a subcript specialization in political propaganda. In spite of the fact that he was not yet twenty-five, his brilliant pre-conquest achievements on two outer

planets only recently occupied by the Empire had earned him the A-3 classification, which automatically made him both a specialist and an authority.

It was Rex's duty to lull any immediate fears the inhabitants expressed, to create in their minds a desirable concept of the purposes of the expedition, and to discover immediately a basic symbology by which communication could take place. Rex was sublimely self-confident about ultimate success, if the thirty men could create a good first impression. That depended not so much upon his own efforts as upon the group pattern. The thirty men were all A-3's, each an authority in his own field, but, like so many who specialized, inclined to be blissfully ignorant of other areas of specialization.

Lounging in the bright meadow flowers, they awaited the arrival of the beings from the nearby city. But time passed, and no one came. This complete lack of reception was a totally new factor. It violated the established pattern. No conquest could proceed without contact. They were being forced to improvise, and as a general rule all improvisation unapproved by the Empire Council was both dangerous and deviationist.

Shortly before dusk, by common agreement, they decided they must go to the city. The primitive atomic guns seemed inadequate, and each man armed himself more heavily.

Just beyond the meadow there was a broad, white highway. In the outskirts of the city they found neat, one-storied dwellings centered in plots of grass and flowers. The signs of habitation were everywhere.

But each house they investigated was empty.

Yet in some houses the tables were laid with pottery, utensils obviously used for eating. The ware had been only recently set out, for there was no dust on it. In one house they found pots of food resting on a black-painted grill over an enameled apparatus which was clearly a kind of heating unit.

There was not a sound in the evening air, except for the occasional calling of birds. Several times they saw small, furry animals lurking in the shadows, but the tiny creatures fled before they could be caught. They were flippant little things, quite at home in the city. Some of them screeched in shrill whines at the intruders; others howled and barked angrily before scampering away.

As the thirty men approached the heart of the city, the neat homes gave way to larger structures which were built flush against the walk. The streets were brightly lighted by glowing globes which hung from tall poles. Huge, ground-floor windows in the tall buildings were brightly lighted, displaying arrangements of goods.

But where were the beings who had wrought this?

Rex was incapable of suspending

judgment. He had to understand the why of it—now. He began to wonder if the elusive, furry animals were, in fact, the people of the planet. The whining and barking could have been a language. They were unlike any other race the Empire had discovered in the galaxy, but any sort of biological variation was theoretically possible. He did not even consider that the animals might have been pets; the custom was too primitive, abandoned at home long before the Empire had come into being.

Rex always formed immediate tentative opinion upon a basis of apparent data, although he was not aware that he did so and he would have denied it vehemently. Methodical caution, the careful construction of hypotheses even for a trivial situation, all the sound and tried methods which had made the science of the Empire supreme—these were the basic tenets of his education. To question them was heresy; to formulate thought in any other manner was deviationism. Rex was an anachronism, responding to imaginative insight rather than to fact. His brilliant achievement of status as an A-3 so early in life was the result of two happy circumstances: first, his insight frequently corresponded to subsequently established fact; secondly, he was capable of making lightning changes in his own mental position as the scope of the data widened, and of doing it so skillfully that he was himself unaware of the change.

The thirty men halted at a square in the center of the city. In groups they fanned out to investigate the nearby buildings. They found nothing more than they had already—endless, empty rooms filled with the things of civilization but devoid of life.

A sudden, terrifying pulse of fear swept through Rex's mind, a fear without words, a fear he could not express. At almost the same time something similar gripped the others. For a moment they huddled together, muttering among themselves and glancing up at the towering buildings.

Then one of the technicians began to shout fiercely:

"Come out! Come out! We know you're here!"

The mocking echo of his voice was a flame that set off the full combustion of violence. Shortly all of them were shouting threats at the empty air and, seconds later, someone began to shoot out the windows in the buildings. There was a strange comfort in hearing the sound of gunfire in the deserted city, the clatter of falling glass, the crumble of shattered masonry.

They broke into the display windows, destroying the fragile, nameless luxuries, sampling the foods, making fun of each other with the weird clothing. In one place they found shelves stacked with a bottled liquid. The taste was delightful, if somewhat astringent.

Rex joined with the others wholeheartedly, because he knew that vio-

lence was a sane antidote for fear. After they had emptied the stock of bottled liquid, Rex's mind began to fog a little. Vaguely he was aware that they went out into the city again. They began to shoot out the globes that lighted the road. It developed into quite a sport, and by no means as simple as it seemed. Recklessly Rex gambled percentages of his share in the conquest on his marksmanship. He was unsure how much he had lost or won, but it didn't matter. Everything everywhere was wonderful. Everyone was his friend.

At last the globes were all smashed. The streets were in darkness. Rex remembered stumbling back as far as the square with his companions. They had intended to return to the ship, but it suddenly seemed too far away; it would be difficult to find it in the dark. It was wiser to spend the night in the square. In the morning—

"My weapons do not exist. My spaceship does not exist. I am helpless."

Rex sprang to his feet. Blinding pain pulsed in his head and his mouth was sandy-dry with a bitter thirst. The green lawn of the square reeled sickeningly in glaring sunlight. His first organized thought was the realization that the pleasant liquid they had consumed had been liquor. In history classes at the air school he had read about it, a dreaded alcoholic poison long ago outlawed by the Empire. His second organized

thought was to recognize the voice again.

"My weapons do not exist. My spaceship does not exist."

It was his own voice, whispering in hushed terror.

The horizons of his perception widened. Rex saw the mob of silent people encircling him and his companions—men and women like himself, the inhabitants of The Enigma!

"My weapons do not exist. I am helpless."

The low-keyed voice beat at him monotonously; he could not shake it off.

All thirty of the men were awake, crowded in a knot together. The mob slowly closed around them, tightening like a noose. Frantically Rex reached for his gun, but the holster was empty. "My weapons do not exist. I am helpless."

An elderly man dressed in loose-flowing white garments that resembled a toga left the crowd and approached them. He was smiling warmly, yet the fear beating at Rex's soul increased. When the old man spoke, his tone was rich and musical.

"We make you welcome to our world. We give you good welcome as friends."

The words were of the common tongue of the Empire! Rex knew at once that the elderly man was not speaking from the full vocabulary which was permitted to the A classification; this was merely the crudely worded welcome which could be constructed out of the basic vocabulary that was taught to all other

Empire manpower classifications.

"Have ease. We give you only good."

Rex had been appointed to the expedition in order to bring about communication with the native Enigmans. His companions looked to him to frame a reply to the old man. In one sense his task was enormously simplified, since he had no foreign symbology to decipher, yet the problem of using the basic Empire vocabulary was almost insurmountable. Rex knew only too well its carefully planned limitations. Thought, to exist, had to be expressed, communicated; the scientific restriction of language, Empire philologists had demonstrated generations ago, automatically limited the scope of thought. It was an axiom of the Empire that to control thought was to control deviationist tendencies. And now Rex was forced to use that restricted, emotionless, milk-and-water tongue for emergency communication!

"We give back all good," he said. Everyone beamed.

"Where are our guns?" The word was not in the basic vocabulary, of course. Military terminology was taught only to the B classification, and there was no contact allowed between the military and the general public. None the less, Rex thought he could make his meaning clear by pointing to his empty holster.

"My weapons do not exist. My spaceship does not exist." The unquenchable whisper was suddenly

loud and intense.

"Others like you have come here," the old man answered, ignoring Rex's question. "We know how to give you ease and good. You must come with us."

"Our wish is to go back to the spaceship."

"After you have food and rest."

The spirit of the mob seemed friendly and, in any case, resistance without weapons would have been futile. The thirty men were taken to one of the large buildings on the city square, and led up a flight of steps into a pleasant, dormitory room. In an adjoining kitchen three women were preparing a meal on an enormous apparatus like the one Rex had seen in the deserted house on the outskirts of the city. Food was in pots which stood on a black grill over circles of metal from which a steady flame sprang up. Now that he saw the cooking process, Rex knew what the machine was. The word for it was "gas stove." He had seen it pictured in the histoscope at the air school. Decades ago the Empire had used the device; now, of course, they had the automatic food dispensaries and the tube foods, at least for the nobility and the A classification. Rex was both uncertain and incurious about the lower groups.

The cooking method, more than anything else, revealed the time-category of the Enigman civilization. There was a superficial physical resemblance between Rex's own people

and these, but the Enigmans were decidedly primitive, an inferior race. Nothing would be lost to galactic progress by their conquest and liquidation.

While the thirty men ate—and Rex was frank to admit to himself that the meal was surprisingly good—the old man chattered continuously, perhaps to keep them from talking among themselves, perhaps to set their minds at ease. Rex gathered that other visitors from the Empire had come, as they had, and had been received in this same way. From them the Enigmans had learned the basic tongue. All was quite logical—the adventurers who had attempted to penetrate the mystery of the planet had been from the lower classifications; they would not have known the language used in the air school. But why had none of them returned? What had become of the million men in the air fleet that had attacked the planet?

The old man said they were to make themselves at home in the city. They could live as long as they liked in the dormitory; it had been built especially for such visitors as themselves, because the Enigmans knew the strangers felt more secure if they kept together. They were free to go where they pleased, to see what they liked.

"As we have before, we will give you good help. One of us will go with each one of you at all times, to make answers for your questions and to see to it you do not lose your way. I will bring in my people now."

Rex and his companions were left briefly alone. In low whispers they began to talk. Each of them shamefacedly admitted he was fighting an identical inner emotion, an identical fear.

"We are being foolish," Rex said, but with no conviction. "These are primitive people, barbarians. It is illogical to fear them, to conceive of any sort of force they can use against us."

"But our weapons do not exist, Rex! We are helpless!"

"Nonsense," someone else said, with as little conviction. "They left the liquor to trap us. When we slept, they stole our guns. We can still make a break for it and get back to the ship."

There was a long, tense silence. Then, as if the words were torn out of him against his will, one of the men said:

"The spaceship does not exist."

"That's absurd," Rex answered weakly, fighting the whisper that shouted in his own mind. "What could they have done with it?"

"Destroyed it, as they have our guns."

"Impossible. No force known to the Empire could penetrate the metal; what could a primitive race do against it?"

"Then the ship has been removed, hidden away to—"

"Again, what power did they use? The negative field would begin automatic reaction as soon as any foreign substance touched the ship."

"None the less, Rex—none the

less!—the ship does not exist.”

The old man returned, then, bringing with him the native Enigmans who were to accompany them as they toured the city. Rex had taken it as a matter of course that their guides would be soldiers or, at least, armed police. He was completely bewildered when the old man introduced them to thirty ravishingly beautiful women, dressed seductively in free-flowing togas of pastel shades.

“These are our guides,” the old man explained. “They have the words of your language, and will be go-betweens for you in talk with our people until you have the words of our tongue.”

The woman assigned to Rex said her name was Naimada. She was as tall as he, olive-skinned, dark-eyed. Cosmetics accented the sharp slant of her eyebrows, curling back into the roots of her glossy, black hair. Her pursed lips were thick and sensuously red.

Logically he knew that under no conditions should he separate from his companions. But it was impossible to fear an unarmed woman, in spite of the throbbing whisper of his own voice that pounded inside his brain. His companions were as susceptible as he. They went bravely forth to tour the Enigman city which they had come to conquer:

Rex had a mild curiosity to examine the folkways of the barbarians who inhabited Enigma; after all, he was a trained scholar and

scientist, a specialist of the A-3 classification before he was thirty. But his first objective was to get back to their spaceship without arousing either the suspicion or the fear of the natives. He had no doubt that Naimada could be bent subtly to his purposes and sufficiently confused to believe them to be her own.

Somehow, it didn't work out that way. The people of Enigma were not as naive as Rex had supposed. Naimada cleverly kept him in public places, among a throng of her fellow beings, who were both curious and respectful. There was nothing Rex could have done to force her to take him to the spaceship; the suspicions of the natives would have been stirred to life, their hospitality transformed into violence. Nor could Rex bring himself to ask her to take him to the ship. When he tried to translate the request into the basic tongue, the whisper of fear rose to a shout in his mind, paralyzing his thought.

At nightfall Naimada took Rex back to the dormitory and left him there with his companions. Much the same thing, he discovered, had happened to all of them. They ate in a gloomy silence, while a group of silent women labored over the primitive gas stove in the adjoining kitchen. When the thirty men were alone, they tried to compare notes, to think through a means of escape, yet each of them was exhausted. Concentration necessary to problem-solving was impossible. Against



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their will, they fell asleep almost immediately.

On the following day Rex made an intriguing discovery. When he was with Naimada, when he concentrated on observing the economy of Enigma and the ways of its people, the fear pounding in his mind ebbed. For long intervals it was forgotten. It came, now, only when he was alone, when he tried to formulate plans for escape.

Again the same thing had happened to his companions. For the first two or three days they talked about it; then, abruptly, each of them fell silent, preoccupied with himself. Rex studied his fellows carefully, trying to see the patterns of their thought. His brilliance in Empire psychology failed him; he could not understand them. Men he had once read as the pages of a book were unknowns, total strangers; they looked at him with veiled eyes, and spoke in generalizations that hid their meanings.

For Rex his failure was acutely painful, a more terrifying torture than the whispering fear. He had reached a conclusion; desperately he had to know if his companions had, as well. The truth of the matter was that Rex no longer cared if he ever returned to the Empire, if he ever found a way to reach the spaceship.

The transformation had begun with his admiration for Naimada's charm and finesse, for the way in which she had been able to manipulate him to suit her own ends.

Steadily his admiration for the woman had widened to include her world. Naimada's civilization puzzled him. There was no central authority with absolute power, no man-power classification, no stratification of society into rigidly separate layers. The only sense Rex could make out of it was that the total society was ruled by the will of the total society—which his whole training told him was idealistic nonsense. No civilization could exist in such an environment. To add to his confusion, Naimada told him that each Enigman was given both necessities and luxuries, in exchange for which he contributed in the way that seemed most suitable to him to the welfare of the whole society.

The Enigmans simply agreed to live together in peace and managed to do so. It was impossible for Rex not to make comparisons with the high-keyed, competitive organization of the Empire. He counted the easy-going leisure of the Enigmans; and he weighed it against the strenuous, self-consuming drive imposed by the Empire.

Rex had never known what it was like to dispose of his own time as he saw fit, to determine his own objectives, and to move toward them at his own pace. He had a multitude of things; he had bodily comforts; he had prestige. But the Enigmans had time—time of their own, time to do as they pleased with no quotas to fill and no imposed goals to meet. Time to live.

Naimada took Rex to the city museum, where she showed him rows of gleaming machines, many similar to the devices which the A classification had at home. The machines had been developed by the Enigmans long ago, she told him, but the products of the machine had come to dominate and drive the whole society. The Enigmans had almost destroyed themselves in greed to possess the things of the machine. Forced to create a better world if they were to save themselves, the people of the planet had gradually evolved a civilization with the happiness of the individual as its first premise.

"Work was a happiness in itself," she said. "Many of our machines were put aside because they took that happiness away. Thus, we do our own cooking now by hand, in the old way. The automatic cooking machines are kept in museums for our children to see, but we have the wisdom not to use them."

"Surely you still have machines for war?"

"Why do you ask?"

"You must defend yourselves against your enemies. You must be able to take territories when you need them."

"That is why you have come here, Rex?"

"Yes." His voice went dead. It had been impossible not to tell her the truth; yet, instead of countering his honesty with rage, she simply laughed.

"It has not been easy to do, has

it?"

"And I no longer have the wish." Again he was amazed at his own honesty.

"Thus we need no weapons of defense, Rex. A long, long time ago—in the days when we had the machines to work for us—we were like you. We were constantly at war among ourselves, and our wars were terrible things, wasteful, disastrous, and fruitless, for when peace came neither side had won. When we made our world over, we made a discovery. A weapon does not make a war, but the hand that holds it."

"You are talking in circles."

"Control the mind of your enemy, and his weapon does not exist. You see the results. You came among us to pave a way for your Empire. Is that not so?"

"Yes."

"And now you feel—what?" She came very close to him and looked up into his eyes. His head swam, and his breath caught in his throat. "You need make no answer, Rex. With you it will be as it was with the others, and you are welcome, as they were."

"When the Empire air fleet attacked your planet," he asked, "what happened? How did you defeat them?"

"We defeat no one, in your sense of the word. But we know that every conqueror follows the same pattern, as you did yourselves when you first came. You march bravely into the cities. You loot and destroy.

You gorge yourselves on the things you find. You eat, you drink, and you exhaust your strength. So it happened with your air fleet—at least that is the story in our books.”

“You defended none of your property?”

“Property is of no value weighed in the scale against living beings. And when a conqueror is fat with his conquest, it is not difficult to begin to change the pattern of his mind.”

Only then did Rex realize that Naimada was no longer speaking the basic tongue; these words were drawn from the full Empire vocabulary, allowed only to the A classification. When he asked her how she came to know it, she replied with a sly smile.

“We always have, Rex; you have learned enough of our ways, now, to begin to hear the truth. We got your tongue from the men in the air fleet which your Empire sent to conquer us. You will remember, the commanders of that expedition were from your nobility. One of them was my own grandfather.”

That night Rex did not sleep. He felt none of the familiar fatigue. Long after his companions had retired, he sat on his bed, his chin cupped by his knees. “Control the mind of your enemy,” Naimada had said, “and his weapon does not exist.” This, then, was what had happened to the others. They had come to conquer and were conquered themselves. It was a workable hy-

pothesis, if the Enigmans were given time to present their cause as Naimada had presented it to him.

He had not the slightest doubt that she was a clever agent, carefully trained for her specialized job. Her position was analogous to his own. She had done to him what he had been sent to do to her people. Rex by no means begrudged her the triumph; instead he envied the process.

But it would be a valid assumption only if the Enigmans had time to present their propaganda! What had really happened to the air fleet, the million-man force that had invaded the planet? The Enigmans would have had no time to convince them, unless the fleet could have been immobilized long enough for the persuasion to begin.

Rex remembered, then, when his whispered fears had started, and at last he knew the answer. Far from being primitive barbarians, the Enigmans had made the ultimate technological achievement in warfare. They had a machine which could control the mind and the will of an invader!

But, in so far as Rex knew, it was impossible to construct such a machine. For the first time in his life, he wondered if he was leaping to conclusions. He doubted the flashing insight of his own intuition.

The Enigmans could have taken their weapons from them while they slept in the city square, but they could not have removed or de-

stroyed the spaceship. Therefore, if the fear had been driven into his mind by a machine, the spaceship would still exist, standing deserted in the flowered meadow where it had landed. It was sound and commendable science to check the slim data on which he built his conclusion. Once and for all he would have to discover the truth about this Enigman civilization.

He pushed back his covers and stole softly out of the dormitory. The whispers in his mind rose to a screeching pitch as he made his way out to the city square. The throbbing intensity was like a physical force, like a gigantic wave of terror grinding against the swaying wall of his mind.

He staggered slowly through the silent city. The fear drove at him out of the darkness. He fought it as he would have fought a strangling undertow, yet the power pushing him back increased as he moved away from the city. The very act of walking forward became a physical and mental torture, but he came at last to the meadow where the spaceship had landed. He saw yellow flowers stirring in the moonlight, but nothing else. Nothing else! The spaceship was not there!

His mind was overwhelmed with black chaos. He turned back blindly, utterly disoriented, and he lost his way.

When he was able to think with coherence again, he found that he had wandered to the other side of the city. Naimada had taken him

there one afternoon, to a cool park nestled at the base of the foothills surrounding the city. There was a large, stone reception house built beneath the towering, granite cliffs. Exhausted, Rex sat on the edge of the stone porch to rest.

The gentle hills rolled away from him. The city was at his feet, sparkling in the clear moonlight. Beyond it he saw the stretching meadows, like the squares on a chessboard. With a touch of nostalgia he looked up toward the sky. That was his Empire, the galaxy, spread above him like a star chart. He picked out the planets and the star systems he had visited, naming the areas where the great Empire battles had been won. He would miss none of it, for, in spite of the Empire training, he felt none of the intimate ties to his A classification that another man would have felt for a family. Craning his neck and looking straight up toward the peak, Rex was able to identify the particular spot in the heavens that he called home—the planet where the air school was located.

But he saw something else, too, a gleam of metal in the moonlight. He looked again and, after a few seconds, he saw the faint glitter a second time. A device of some kind stood at the top of that hill overlooking the city; it turned in a circle at irregular intervals. Suddenly he remembered that when he and Naimada had been in the park he had wanted to climb the hill and she had refused.

His weary nerves leaped with excitement; this chance discovery might be the final solution to his problem. Quickly he made the ascent, for it was not difficult and the hill was not high. On a cleared area at the top he found a large machine shaped like a trumpet and fixed to a solid metal disk. It turned fitfully in the wind.

There was no doubt that this machine was the device which made The Enigma immune. Since it was, his whole fabric of speculation fell to pieces. The defense of the planet did not rest upon the fears that plagued his mind. What was it Naimada had said? "Control the mind of your enemy, and his weapon does not exist." She had been deliberately trying to confuse him, a sound propaganda technique. The fact that she would not climb the hill was the clue to the real truth.

The planet was not defended by anything as precarious as mechanically planted fears. If this machine did that, the whole society would have been shattered by the same horrors. The only other logical possibility was the literal truth: this device actually destroyed weapons of war. He had no idea how. He was too weary to test the logic or the consistency of the argument. He knew the spaceship was gone; he had seen that for himself. An invasion of the planet was impossible, as long as this machine functioned.

As long as the machine functioned!

Rex understood the implication—

the fate of the planet was in his hands.

He owed the Empire nothing. The reward of victory was in things; the reward of Enigma was time. He had already made up his mind.

Slowly he descended the slope of the hill and went back to the dormitory.

It was nearly dawn. Some of his companions were stirring restlessly on their beds; one of them muttered indistinctly in his sleep,

"Morrow reporting, sir; the planet Enigma has been conquered for the greater glory of the Empire."

Rex was already exhausted. He was now swamped by the first shattering shock of melancholia he had ever experienced. If he had found the machine so easily—the secret of the planet—any one of his companions might yet stumble upon it. And which of them would hesitate about destroying it?

He might talk to them; he might attempt to convince them; they might even seem to agree with him. But he could never be sure. As long as they lived, he would never know positively that The Enigma was still safe, that its quiet sanity would survive.

He remembered the lessons on the histoscope at the air school. There was only one thing he could do. It seemed right and it seemed good. The decision gave him a glowing feeling of satisfaction and of self-respect.

Stealthily he shut all the dormi-

tory windows. Quietly he went into the kitchen and turned up all the burners in the gas stove. While he waited, he took a piece of paper and wrote upon it. The letter was addressed to Naimada.

In sorrow, the old man and the girl stood at the door. The respirator squads were working feverishly, but they had come too late. The girl held the letter listlessly, and her slant eyes swam with tears.

"It sometimes happens like this," the old man said, taking her hand. "We have no way of knowing in time to prevent it. It isn't your fault, my dear."

"But I told him the truth! And then he writes me this nonsense about machines."

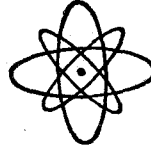
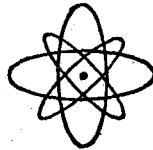
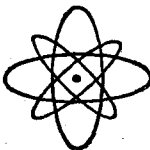
"It is impossible to reconstruct the workings of a mind, but I would guess that the truth seemed too simple to him. Remember, he comes from a barbaric society which has still to move beyond the machine age. You tell him that we control the mind with hypnotism, yes, but

he cannot believe you. As you know, even in their full vocabulary they have no word for a science of the mind. They think only of externals, of visible, tangible things. Therefore, Rex was convinced that you were misleading him; he was sure we had a machine to do the work for us. Then he stumbled on that old radar unit up on the hill, and he quite naturally assumed it was a device which protects our planet."

"In a sense he killed them all for us." Her voice choked. "He wanted to remain here, but he had doubts about the others."

"You understand the irony, as I do, but how was Rex to know that the others had already accepted our ways, and were waiting only for a sign from him? He died bravely for something he could believe in. You must forget it, Naimada. You did your best. There will be no other visitors coming for quite a while. Take a vacation; get this unhappiness out of your mind. Go up to New York and see a few shows, or out to Sun Valley for the skiing."

THE END



THE ANALYTICAL LABORATORY

This department is not ordinarily used as an editorial-viewpoint medium; this time the discussion really is part of Analytical work. "Day of The Moron" took first place; it was a good yarn. In the Brass Tacks next month is a long, and, I think, extremely sound discussion of human beings, and that story. The story, as I think a majority of our readers realized, was not anti-labor; it was anti any system or setup that sought to make arbitrary rules replace the judgment of intelligent men, against any system wherein one man, for arbitrary reasons, could determine issues involving myriads. Labor was right; the shop foreman's authority needed to be restrained, the arbitrary of a one-man decision had to be opened for sincere investigation. But the arbitrary of the one-man decision should apply as equitably to the shop steward as to the shop foreman. With growing understanding, management has recognized thoroughly that it is not sound, reasonable or just to act on the word of one man; investigation before acting should be the procedure.

"The Day of The Moron" merely posed the question in reverse: Can it not equally be said that an arbitrary, not-too-understanding shop steward can sometimes find his way into the wrong spot at the wrong time? And does Labor have as good and just a mechanism for controlling that situation as they have induced management to establish? And the story posed this further, and very serious question: Is it just to discharge a man for what he *may do*, not for what he *has done*?

Those points, I sincerely believe, are worthy of open discussion and settlement. Because I believe that, I published the story. It cannot be said that Street & Smith is, or ever was, anti-labor, nor am I. But I do want to seek out fair answers by open discussion.

In any case, the ratings were:

SEPTEMBER, 1951 ISSUE

Place	Story	Author	Points
1.	The Day of The Moron	H. Beam Piper	2.14
2.	Untitled Story	Frank M. Robinson	2.39
3.	The Universe Between	Alan E. Nourse	2.57
4.	Brick Wall	J. A. Meyer	2.82

THE EDITOR.



THE EDGE OF FOREVER

BY CHAD OLIVER

Semantics is a very tricky thing; cultural patterns are very tricky and misleading things. "Time of the Terror" didn't sound like a technical term at all . . .

Illustrated by Rogers

Dale Jonston gripped the palisade logs until his knuckles went white with strain and tiny droplets of blood began to form under his fingernails. The humid air choked his throat and a cold sweat beaded his forehead and trickled down the inside of his ETS shirt.

Start, his tense mind whispered. Why don't you start?

The massed black clouds rolled over his head like a dark sea suspended in the air. Drums of thunder throbbed in the west and an electric hush charged the atmosphere. Lightning flickered in ghost-flames around the distant peaks of the Hills of the Dead.

It was the Time of the Terror—and the Terror was coming.

"It will be soon now," a low voice echoed his thoughts.

Dale Jonston jumped inwardly at the sound and then forced himself to relax. He turned around. A tall native stood there watching him, a faint smile playing across his proud face. In the murky haze the light blueness of his skin was all but invisible.

"Good to see you, Lkani," Dale Jonston said. "This weird weather of yours has just about got me down—you almost scared me to death creeping up on me like that! Don't you ever make any noise?"

"Perhaps you should tie a bell around my neck," the native suggested. "Is not that what you do to keep track of the animals on your planet?"

"Your sense of humor can be a trifle . . . startling, Lkani."

Dale Jonston eyed the native thoughtfully. These people never ceased to surprise him, and he had been stationed on Rohan for two years now. The planet was referred to officially as Procyon Twelve, of course, but no one who had ever been there called it by that colorless name. When in Rome—

"It is coming," Lkani said quietly, pointing out into the gathering darkness. "My people have all gone from the Changing Lands—they are waiting in the hills. They will not have to wait long."

Dale Jonston felt his jumpy nerves begin to settle down. He shouldn't let it get him this way, he realized. But this brooding weather

did something to a man. It was like waiting for a bad hurricane back on Earth, when you sat around interminably in the still air and watched the barometer fall. It had been like this for weeks now.

And there were the Others—the people of mystery that no man had ever seen, custodians of a civilization that spanned the far-flung stars. Somehow, in the mutter of the thunder and the clouds of darkness, he knew that they were near. Watching. Waiting—

"You know we'd be glad to have you on the Post," he said. "We've got room for fifteen or twenty, and our buildings may be able to take what's coming better than your settlement in the hills."

"I will stay with my people," Lkani said. "We have been through the Terror before—you have not."

"You've got a point there at that."

The motionless, dead-smelling air pressed down on them heavily. The yellow squares of light in the windows of the Post buildings looked safe and comfortable. Dale Jonston was glad that they were there.

"You had better get inside before it comes," Lkani said.

"I guess I'll have time for *that*, anyway," Jonston replied.

"It comes fast," Lkani smiled.

"Well, if we can be of any help to you just whistle or beat on a drum or something."

"If *we* can help *you* just flash us a radio signal or send up a mag-nite flare," Lkani countered.

"You win," Dale Jonston laughed. "Sometimes I wonder just who is kidding who around here."

"Here it comes," said Lkani.

The charged air trembled and thunder blasted savagely across the plains. Great livid bolts of lightning slashed jaggedly down and tore at the crouching vegetation. The sound swelled to a shuddering roar that pounded the ears with physical force.

"Merry Christmas to all," Dale Jonston whispered dazedly. "And to all a—"

He never finished. He had a split-second's warning as a fresh wet smell hurtled in from the plains and then it hit. Rain! Rain such as no man on Earth had ever imagined—rain that slammed down in a blinding torrent, rain that thundered and pounded and choked.

Ten years it had been pent up in a monstrous reservoir—and now the Gates of Hell were opened wide!

He felt his feet slipping out from under him and he coughed desperately as water clogged his lungs. The rain beat at him with a million wet hammers and he knew he was going down. The ground under him was already a sea of mud.

A strong arm came out of nowhere and supported him as he stumbled back toward shelter. He gasped and coughed and tried to wipe the blinding sky river out of his streaming eyes. He staggered into the main Post building and the door shut behind him.

"Lkani!" he choked.

He was alone—Lkani was gone.

He leaned against the log wall, fighting to get his breath. The rain pounded down on the Post as if determined to rip it to shreds. Thunder roared as the gods went mad.

Quite suddenly, Dale Jonston was chillingly aware that he was a long, long way from home.

Dale Jonston paced up and down the floor of his office, puffing on his pipe and listening to the hammer of the rain on the roof. It never stopped, that rain—it ebbed and flowed with savage fury, but it never stopped. It made Earth's mightiest cloudbursts seem like gentle drizzles and it went on forever.

"Sit down, Dale," said Tom Troxel. "You're making *me* nervous."

"Sorry," muttered Dale Jonston, seating himself behind his desk.

"It's only rain," Troxel offered.

"Sure—and the H-Bomb is only atoms."

"Take it easy—you can't stop the rain and there hasn't been any trouble yet."

"Yet—that's the word I don't like."

"What can happen? So it rains for six months or a year—it won't kill anybody."

"Won't it?"

There was a splitting hiss followed by a jarring blast of thunder. The rain droned on and it was cold in the room.

"I don't follow you," Troxel said.

Dale Jonston got to his feet again and walked over to the duraglass window. He stood there and watched the rain wash across the glass like tiny breakers. That was all there was to see—the rain and the darkness.

"Do you know what it's like out there now?" he said quietly. "It's been raining like this for three weeks now and no one knows for sure how long it will go on. Those lowlands have been saturated, drenched. They're wild swamps now, filled with great white worms crawling up through the soft ground. The natives are all crowded together on the hilltops and the caves are roaring underground rivers. The natives call this the Time of the Terror and they're not just coining phrases for the fun of it. There's a reason—things *happen*."

"You think the natives will act up?"

"No, they're intelligent people and they're better adapted to these conditions than we are. I'm not much worried about the natives."

"Then—"

"You know man's greatest enemy is not alien natives, not monsters, not the Others—but himself. Man is his own destroyer. He always has been, down through history back on Earth, out in space when he got to the planets of his own solar system, and now here. He won't change just because he's on a planet that belongs to another sun."

The rain thundered down and a cold wind whined around the little buildings of the Post. The light on Jonston's desk threw blurred shadows on the log walls. Troxel shivered and lit a cigarette.

"Yes," Jonston went on, puffing slowly on his pipe. "I'm worried about us—us, the mighty Earthmen. I tell you, you take any group of selected spacemen, men who have been carefully conditioned and psychologically screened—you take 'em and coop them up somewhere for a year. Put pressure on them; don't let them see a living person except themselves. They *may* come through O. K.—and they may not. And we're not dealing with trained spacemen here, Tom. Intelligent workers, sure, but not trained spacemen."

"I'm receiving you."

"Take any two ordinary people—good friends, maybe—and lock them in a room for a year. Watch what happens; the growing tensions, the little arguments, the brooding hostility that develops. Multiply that by a hundred or so, toss in this infernal rain and a planet light-years away from home, complicate the situation with great worms and God only knows what else, add a few natives—"

"And don't forget the Others," Troxel added with a grin.

"I'm not forgetting them—not for a minute. They're an unknown factor, and hence doubly dangerous. Tom, I wish *you* were in charge of this Post. I'd sit around with a

fiendish leer on my face and concoct enough gruesome situations to make your hair stand up on end and sing the 'Deep Space Blues'."

"I hear the swamp is full of dinosaurs, too."

Dale Jonston looked at his prematurely bald junior officer and gave up. He was glad he had a man like Troxel around. It took a lot to panic a man with a sense of humor, and Troxel was no fool. Jonston realized that Troxel was deliberately forcing him to relax, and he appreciated it. He needed to calm down, and no mistake. It wouldn't do for the commander of the Post to blow his top at a time like this.

He opened the bottom left-hand drawer of his plastic desk and took out a bottle and two glasses.

"We'll see if we can conjure up a couple of pink elephants to add to your menagerie," he said. "Have a drink."

Troxel's eyes brightened, as he hitched his chair up to the desk.

"Hm-m-m—Old Rocket Fuel," he enthused, "That's what Admiral Groten was drinking just before he passed away, poor man. You know what his last words were?"

"Afraid not."

"He said, 'I don't see how they can make a profit on this stuff at twenty cents a fifth.'"

"I told you that man was his own worst enemy," Jonston said with a smile. "Jokes like that might well destroy civilization."

"Right you are," Troxel agreed

cheerfully. "Let's drink our first drink to the Others."

Jonston raised his glass.

"To the Others," he said quietly.

Outside, the great storm lashed out at the planet, churning the lowlands into swampy ooze and pelting the mountains with a driving deluge of rain. It was a chaos of thunder and lightning and wind. And, if you were of an imaginative turn of mind, you could hear, between the Post and the Hills of the Dead, the slithering of the great white worms. . .

It was night on Rohan and the Post was still. Dale Jonston sat alone at his desk, listening to the monotonous hammer of the rain on the roof. There was no visible difference between night and day, but you always knew, somehow, when night had come. You felt a strange chill in your blood and your mind did odd things with the shadows on the walls.

He permitted his tired body to relax. It had been a hard day; they were all hard. Conferences with psychologists and anthropologists—anthropologists were indispensable in space-travel, he reflected, since they were the only scientists on Earth who were trained to understand alien cultures—supervision of projected entertainments, paper work, and the thousand and one urgent little problems that were forever coming up in the management of any community. He fired up his pipe. Funny how much civi-

lized man depended on tobacco. . .

He had held up pretty well, he figured. He had been keyed up to start with and had stayed more or less at the same pitch, while the rest of the Post had grown progressively more tense as the weeks and the months dragged by. Even Troxel was showing it now—there was a report on his desk from Dr. Moreland that noted the chief psychologist's concern over Troxel's condition.

All he could hear in the night silence of the Post was the sound of the thunder, the rain, and the wind—all scrambled together into a roaring awareness of the storm that never stopped. The lightning teamed up with his desk lamp to throw grotesque shadows on the log walls.

Sometimes, the distance got you. You wouldn't think about it for days; you might even kid yourself into thinking that you had it licked, that you were conditioned to the deeps of space. Then it would hit you—if the great double star of Procyon should happen to explode, *it would take over eleven years for the light of the explosion to reach the Earth.* That's a long way to be from home—a long way from the green fields and the trout streams and the girl you hoped would be waiting. . .

He sat back in his chair, puffing slowly on his pipe, eyes closed. You could never explain a planet like Rohan to the people back on Earth; it was one of those places that only

the spacemen would ever know. You might show them pictures, talk to them. You could tell them that Rohan was a world where everything was adapted to a peculiar, seasonal rain cycle. Due to the pull of the double star, an odd inclination of the planet's axis, and great quantities of the spongelike substance frondal in the upper atmosphere, it only rained once every ten years—and then it really *rained*.

You could tell them of the wonderful storage roots of the plant life, and of how they cast off millions of globular seeds just before the storm. The plants were largely destroyed by the pelting rain, but the seeds floated in the black muck and germinated after the storm.

You might describe the intelligent, blue-skinned natives of Rohan, and tell how deceptive their simple culture was from an anthropological point of view. Their economy was a standard hunting-and-gathering one, and they lived in small groups on the great plains. When the rains came, they retreated to the hilltops, where the unusual crowding and emotional tensions brought about the periodic Time of the Terror. They lived then from storage bins and small mammals which took refuge with them on the high ground and fish in the few caves which were not transformed into torrential underground rivers.

You could tell them about how the great plains turned into abysmal swamps filled with the crawling white worms that had been dormant

underground during the dry season. You could tell them all about everything—except what counted. You couldn't tell them how it *felt*.

Dale Jonston nodded sleepily, too tired to go to his room.

Men flamed up from the Earth and fought their way to the stars for many reasons—ambition, greed, glory. But there was only one thing that kept them on a planet once they had reached it—and that was a composite reason of economics. It might not always be so but now, in the infancy of interstellar travel, that was how it was working out.

The planet had to *produce*. So it was with Rohan, a planet rich in mineral substances and medicinal plants nowhere else available. The Proclamation of Equal Rights for All Intelligent Life had nipped exploitation in the bud, to man's everlasting credit. Trade was carried on pretty much on a mutual-benefit basis, within the limits of human failings and the alien psychologies and cultures found on the far-flung worlds. The natives of Rohan were indifferent; they had their culture and were perfectly content to let the men from Earth have theirs. Earth had nothing to offer them except terrestrial civilization, and Dale Jonston often considered that to be at best a dubious blessing. He thought of Lkani, with his shrewd intelligence and quick humor. Lkani was by no stretch of the imagination an "inferior being"—indeed, Dale Jonston sometimes wondered just

which race was tolerating which on Rohan. . . .

The storm roared on, tearing at the building. The rain poured down until you couldn't remember a time when the sun had shone and the sky had been any other color than black. The men were getting sick of the sight of each other. They laughed too much and too loud. You'd be sitting around and all of a sudden get an almost uncontrollable urge to sock somebody—anybody.

And then you would remember that you were a man, and that the Others were watching.

The Others. Who were they, what did they want? No man had ever seen them, but they were there—there in the vastnesses of space, waiting, watching. They were there in strange contacts on radar screens, there in alien artifacts found on distant worlds, there in the whispered legends that a thousand thousand primitive tribes whispered around their campfires in the sky.

It was rather painfully obvious that man, despite his once self-centered assumptions, was not the only intelligent race in the galaxy. He was out to carry his civilization to the stars—and someone was already there! Somewhere, sometime, they must meet. And then—what?

The best minds on Earth had wrestled with the problem and had come up with a few simple propositions which were unusual only in that they began to show the common sense of man's maturity. One, there was already in existence a galactic

civilization of a high order. Two, Earth could not hope to fight it—it must *join* it. Three, the men from Earth must first prove that they had finally grown up before they could expect any overtures from the Others.

Always, down the black rocket trails between the stars, men could feel their presence. Somewhere, lost in infinity, the Others watched and judged.

Dale Jonston got wearily to his feet and switched out the light. He walked slowly through the long halls to his room, nodding at the sentries as he passed them. The rain beat down with a terrible relentlessness and lightning hissed down on the swamps.

Here he was, he thought—one tiny man in this outpost on the edge of forever. And something big was going to happen; he knew it positively with that subconscious sixth sense that made him a leader. Something big—something that might well change the whole future history of that strange species that the universe called man.

It seemed as though he had hardly dropped off to sleep when Dale Jonston came to his senses with a start. He sat up in bed, rubbing the sleep out of his eyes. The storm sounded wet and unpleasant outside and he was glad that he had the warmth of the Post to protect him. He glanced at the glowing dial of his watch. Four in the morning. What in the world—

Then it came again, whining dismally through the night. The alarm siren!

He leaped out of bed and pulled on his uniform, his mind spinning with half-formed conjectures. He ran out of his room into the hall. Lights were coming on all over the Post.

"What's up?" panted Lin Carlson, catching up to him in the corridor.

"Don't know—come on."

Carlson—chief anthropologist at the Post—nodded and they pounded down the hall to Jonston's office. The siren was wailing like a lost soul. Jonston flipped on the telecom.

"Hello, Control," he said tensely. "Get me the Watchtower and stand by."

The steady, relaxed face of the defense co-ordinator flashed on the screen.

"O.K. Williams—Jonston here. Let's have it."

"Over at the main gate, sir. Two sentries knifed—don't know what the deal is yet but I figured I'd better turn in the alarm. I've already told Control to call a red alert."

"Check. Anything else?"

"That's about it—too early to tell what happened. Can't get a thing on the radar. Should I turn the flood-lights on?"

"I'll handle it, Williams. Stand by. Over."

Jonston jiggled the telecom switch.

"Hello, Control. See that the

floodlights are turned on and get hold of Lieutenant Burks—I want an immediate personnel check. Tell the radio room to try to get through to Earth. Tell Burks I'll expect a report here in half an hour—Carlson is here with me. That's all."

He switched off and turned to Carlson.

"Any ideas, Lin? Natives?"

Carlson shook his head and finished buttoning up his ETS shirt. "Don't think so. Of course, I can't tell for sure—but I'd bet a considerable fortune if I had one that those natives are safe. I've studied them for years—it's unthinkable."

"That's my opinion too, frankly. But we can't take chances with that atomic pile in here."

"The Others, maybe?"

"They're still an X factor, Lin—there's no way to tell. Where the devil is Troxel?"

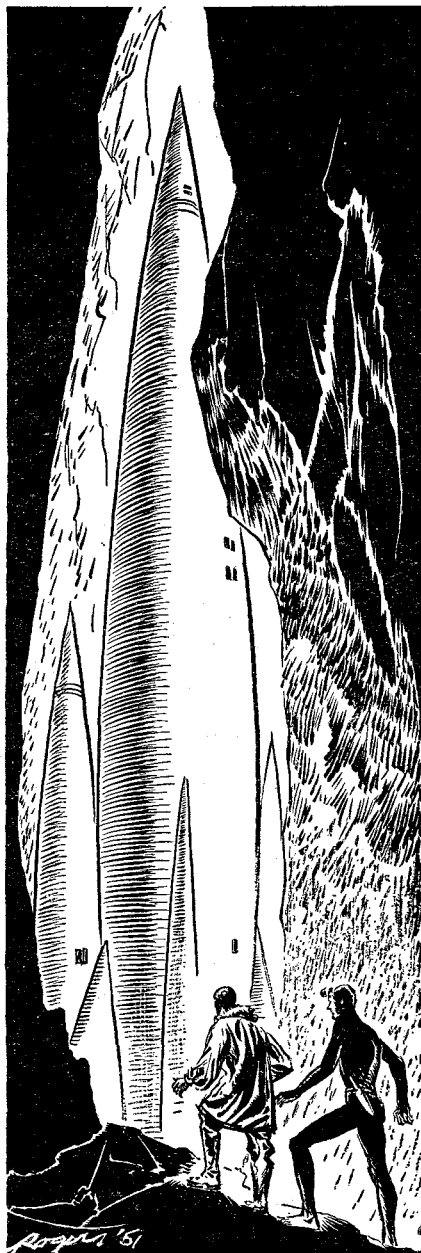
"Still pounding his ear probably. He could sleep right straight through Armageddon."

Jonston drummed his fingers on his desk and thought of Dr. Moreland's psychological report on Troxel. It couldn't be, of course. Still—

"Let's get down there to the main gate and see what goes," he said.

Carlson nodded and they hurried through the Post together. Jonston noted that all the men were properly deployed and that there was no panic—yet.

The sentry house at the main gate was connected to the rest of the



Post by a log tunnel. The gate was simply a door in the palisade wall, and the sentry house was a lonely place indeed during the Time of the Terror; visitors from across the swamps were few and far between.

They went down the tunnel and the storm was very close. The logs were moist and cold. Five armed men greeted them in the sentry house. Their faces were pale. The two bodies on the floor were covered with uniform coats. Jonston looked them over.

"Knife wounds all right," he said slowly. "In the back."

"It's Marks and Richards, sir," one of the men said needlessly. His voice was taut. "They . . . they—"

"They came a long way to die," Jonston finished softly. "All quiet out here now?"

"Yes sir."

"Take it easy, then—but keep your eyes open."

He turned away, beckoning to Carlson, and they made their way back to his office. Lieutenant Burks was waiting for them.

"What did you find, Burks?"

"All present and accounted for, sir, as far as I can tell. Except—"

"Yes?"

"I can't locate either Lieutenant Troxel or Dr. Moreland, sir. I thought perhaps that you'd seen them somewhere."

"No," Jonston said slowly. "No, I haven't seen them."

He sat down behind his desk and began to fill his pipe. The thunder and the rain seemed to isolate the

little room, as though it were all by itself, drifting in infinity. He felt an awful chill race through his veins. Two men knifed in the back and—

"They'll show up, Dale," Carlson said.

Dale Jonston hoped so with every atom of his being. If only Troxel would come barging in, with his smile and one of his countless jokes about the weather. He could see him, in his mind's eye, sprawled in his chair, saying seriously, "It's like I always say, Dale. Everybody talks about Mark Twain but nobody *does* anything about him—"

His thoughts came to an abrupt end as the door banged open. A wet, bedraggled caricature of a man stumbled into the room, his clothes soaked with mud. It was Dr. Moreland.

"I tried to stop him," Moreland choked. "I tried to stop him."

Carlson and Burks helped the psychologist to a chair. His eyes were bright and he was breathing with difficulty. Jonston went around and stood by his side, one hand on his rain-drenched shoulder.

"Try to tell us what happened, Doc," he said.

"It was Troxel," Dr. Moreland whispered, taking a deep breath. "I was worried about his psych report and went around to check on him. And . . . and—"

Carlson handed him a drink. Moreland gulped it gratefully.

"Go on," Jonston said.

"He wasn't in his room. I found him right after he knifed the sen-

tries—he went out the main gate into the storm. I . . . I tried to follow him, catch him, but . . . the storm—”

“I understand,” Jonston said, a sick feeling in his heart. “Did he have anything with him—any weapons?”

“I . . . I think he was carrying something. I tried to get him but the swamp—Dale, it’s . . . it’s horrible out there—”

Jonston listened to the hammer of the rain on the roof. The lightning hissed down on the swamps and the thunder rolled heavily through the black skies. He could feel the cold sweat on his forehead.

“There’s just one thing to do,” he said. “We’ve got to go out there and get him.”

Dale Jonston tried not to think of Troxel as his friend. He was just a factor in a problem that had to be solved. That wasn’t an easy way to look at it, but it was the only way. He knew that Troxel, as junior officer at the Post, had access to the arsenal. There were atomic bombs in the arsenal—and when there’s a madman at your door with an atom bomb it’s already later than you think.

Copters were useless in the storm that raged across the face of the planet, and the ship from Earth wasn’t due for another two months. Dale Jonston smiled without humor. It was strictly a family affair.

“We’ll never find him out there,” Lin Carlson said. “Never in a mil-

lion years.”

“We’ve got to find him.”

“A man might live for a while in that storm,” Carlson pointed out. “But he could never locate anyone else—he couldn’t see two feet in front of him. And if the person being hunted doesn’t *want* to be found—”

“I’ll find him,” Jonston said.

“*You?* You can’t go out there—you’re in charge here.”

“That’s why I’m going.”

“Don’t throw your life away, Dale,” Carlson said. “It’s all very well to be a hero, but what good will it do? You’ll go out there into that swamp full of worms and we’ll all be worse off than we are now.”

Jonston smiled. “Don’t worry, Lin. I’m not going to throw a fit of heroics for dear old Terra—I think as much of my hide as the next man. I think I can find Troxel or I wouldn’t go. You see, I’m not going alone.”

“I don’t get it.”

“Very simple, really—Lkani. He can cross those swamps and he must have some way to see where he’s going. If he’ll help us—”

“I think you’re making a grave mistake,” Dr. Moreland said, shaking his head. “To put the safety of this Post into the hands of a savage—after all—”

“Lkani is not a savage,” Carlson interrupted angrily. “A man of your education, Dr. Moreland, should certainly have better sense than to—”

“Knock it off,” Jonston said

wearily. "This is hardly the time for an argument."

He looked at the lines of tension in Carlson's face and at Dr. Moreland's too-bright eyes. He felt the strain himself—it was like sitting on a powder keg while a paranoiac looked at the fuse and played with a cigarette lighter. There was no longer any time for discussion. He had to *act*.

"O.K., Burks," he said. "Start firing magnite flares across the Hills of the Dead where Lkani and his people are. Get with it."

Burks left and Jonston settled back and tried to relax.

"What do we do now?" Carlson asked.

"Cross your fingers, friend. That's all—just cross your fingers."

The storm lashed at the Post with new fury as if challenging any man to go against it in mortal combat. Jonston thought of Tom Troxel out there, sick and dangerous. *This is the price you pay*, his mind whispered. *This is the price you pay for your ticket to the edge of forever.*

The hours passed. The faces of the men were white with strain. Any minute, any second, the blast could come. And they could only sit and wait. And wait. And wait.

The telecom buzzed.

"Jonston here."

"It's the native chief, sir—Lkani. He's at the main gate. He says—"

"Never mind what he says. See that he's comfortable—I'll be right down."

He flipped off the telecom and got to his feet.

"Can't I go along?" Carlson asked. "Maybe I—"

"Thanks, Lin—but if one man can't do this job then two men or a dozen can't do it either. You hold the fort."

"Well—good luck."

"I still think—" Dr. Moreland began, then thought better of it.

Dale Jonston, already dressed in boots and plastic slicker, hurried out of his office and down the tunnel to the main gate. The rain pounded gleefully on the roof, sensing a victim. Lightning burned furiously through the storm. Jonston shivered. If they couldn't find Troxel—

Lkani was there waiting for him. His blue face was glistening wet in the cold light of the sentry house.

"I saw your flares," he said.

"You don't know how glad I am to see you, friend," Jonston said. "We're in a mess."

He explained the situation to the native, wasting no time. Lkani listened carefully, nodding his head from time to time. The storm howled mournfully around the log house and the rain came down in torrents.

"I understand," he said finally. "I will try to help you, of course—but it will not be easy."

"If you ever want a medal, Lkani, I'll get you a dozen or so."

"I'm afraid they would be of little use to me," Lkani smiled. "Are you ready?"

"As ready as I'll ever be."

"Then let's go."

Two of the sentries opened the gate and a wet hell blasted in. Dale Jonston's heart hammered in his throat. He looked at Lkani and tried to smile. This, emphatically, was *it*.

Shoulder to shoulder, the two men walked out into chaos.

The thick mud sucked at his feet and the rain pounded his body. Dale Jonston's skin crawled under the cold lashing of the wind and he noticed wildly that the rain smelled like metal. *Like standing under Niagara in a raincoat*, he thought numbly.

He couldn't see; he plodded on in a nightmare fantasy of unreality. He was afraid and his stomach felt hollow and cold. He held closely to Lkani's arm and forced himself to keep going. Where? Somewhere—anywhere that Lkani went. Through the storm, through the sea of rain, through the darkness.

The rain choked in his lungs. He couldn't think but his mind was spinning with livid images. And questions—questions that screamed in his head, questions that had no answers. How could any man, sane or not, stay alive in this shrieking attack of the elements? How long could *he* take it? How could Lkani find his way through the swamp—how could he know where he was going, much less how to get there?

A man might live for a while in that storm, Carlson had said. *But he could never locate anyone else.*

Jonston gasped for breath and pulled his feet through the muck.

Lightning sizzled through the wet air and hissed into the swamp behind them. The thunder crashed with an ear-splitting roar. It was too much for any man to take—but Jonston kept his head down and went on. There was no other way to go.

His mind began to think about the thousands of slithering white worms that undulated through the swamp and terror crept like ice through his veins. His feet were tense and uncertain in the mud, as though he were walking through the ocean surf back on Earth with Jellyfish between his toes.

Lkani stopped.

"What's the matter?" Jonston yelled above the pounding of the storm.

Lkani pointed and Jonston followed his arm. There was something in the muck, something dark. Jonston knelt against the force of the rain and rolled it over.

Troxel. Troxel—with his neck cut almost in half by a knife.

Dale Jonston got numbly to his feet and stood there swaying in the blast of the storm.

"Tom," he whispered.

That was all. There was no time for anything else. He had to whip his mind into action, had to *think*. Lkani was silent in the wind-driven downpour, waiting. Jonston clenched his fists. *THINK*. The rain hammered at his face.

Troxel was dead in the swamp, knifed. He hadn't killed himself, that was obvious. In all probability, he

hadn't killed the sentries, either. *Troxel wasn't the man they were after.* O.K. Someone had cracked, and it hadn't been Troxel. Who, then?

Jonston thought back. He shook his head, half in anger and half in fear. He had been tricked, neatly and completely. Fainted out of position like the greenest cadet.

"Dr. Moreland," he breathed.

Of course. It was Dr. Moreland who had made out the psych report on Troxel, Dr. Moreland who had "seen" Troxel knife the sentries, Dr. Moreland who had come in wet from the swamp, Dr. Moreland who had been afraid to call in Lkani.

And he was inside the Post and he outranked every other officer.

Dale Jonston looked down at the thing that had been his friend and made himself think the problem through. He ignored the thunder that blasted through the darkness, ignored the choking rain, ignored the cold wind that whistled through his slicker. *Think—*

Dr. Moreland had cracked under the strain of the storm and too many tense mental problems of others. He wasn't a villain; he was sick. But he had to be stopped. He had tricked Jonston out of the Post and he had killed three men with a knife. He couldn't go on like that, Jonston realized. He would either have to stop killing altogether, which wouldn't be likely, or—

Or he would have to destroy the entire Post, himself included. How

could he do that? There were atomic bombs in the arsenal—but Jonston doubted that Dr. Moreland could get into the arsenal alone. Even though he outranked the other officers, he was a psychologist and would have no business in the arsenal. The other men were not fools; they would become suspicious and that wouldn't do. What else then? Jonston shivered. The atomic pile, used to power the mining tools. There would be guards in the arsenal, or supply men at least, because they were on the alert for an attack from *without*. But the atomic pile—Moreland could get to it—could tamper with it.

No man in his right mind would alter the pile, of course. But that was just the point. Moreland was no longer sane.

Dale Jonston could visualize the scene—Moreland in the room with the pile, warning the others that they must not approach him. Yes, Moreland would have to let them know what he had done—have to taunt them with his cleverness and feel like God with the power in his hands. A working knowledge of psychology was not by any means restricted to the psychologists in the Extra Terrestrial Service—it was standard equipment.

Lightning hissed into the swamp again and the rain slammed down harder with the push of the thunder. Jonston smiled coldly. *All right, genius, he thought. You've figured out what you should have known all along—now what are you going to*

do about it?

He put his mouth next to Lkani's ear and hollered above the storm. If this didn't work—

"Lkani, Moreland's going to detonate the pile. It will destroy your people as well as mine. What can we do?"

Lkani was tall and dark in the driving rain. His steady eyes measured Jonston carefully.

"Just think the facts of the situation," a voice spoke clearly in Jonston's stunned brain. "Then follow me."

Dale Jonston stood there staring.

So, his mind whispered, *he can read minds, too.*

The storm lashed out at them with sentient fury and the darkness covered the two men like a shroud.

No matter what men say, and no matter how good an act they may put on for the world, there is within all men a pragmatic core that always knows what the true score is. And within that core, despite their outward egotism, men usually underestimate themselves. Dale Jonston would never have believed for a minute that he could take what he was taking and go on asking for more. But he could—and he did.

He didn't think about it. He just kept plodding forward, holding on to Lkani's arm and pulling first one foot and then the other out of the eternal mud. The rain beat at him and the wind tore at his clothes. He felt as though his lungs were on fire and his eyes burned in his skull.

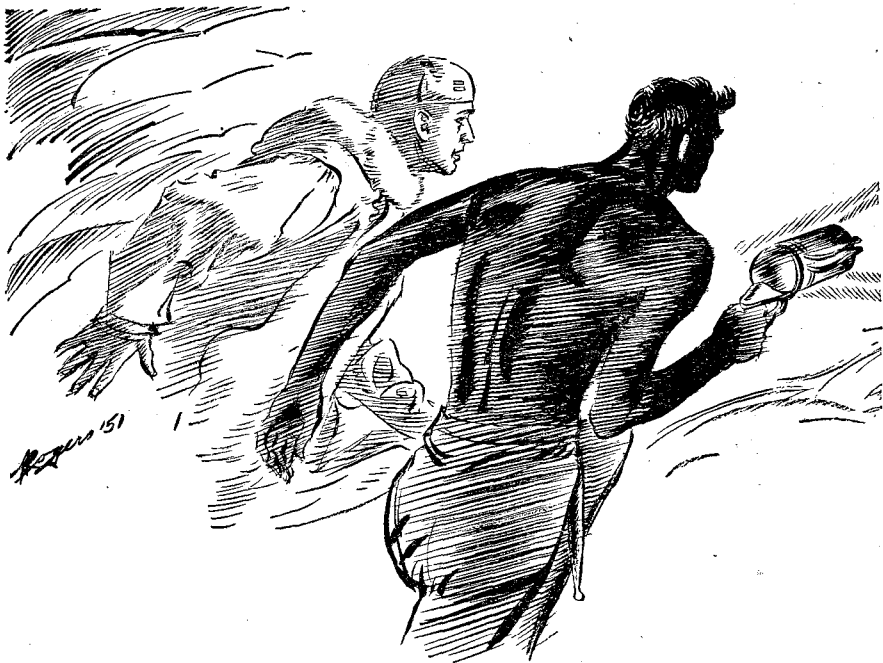
Every second he expected the blinding flash from the Post—the flash and the end.

But they were moving away from the Post, he sensed. Toward the Hills of the Dead. He shuddered, feeling the unthinkable coils of the great white worms slither past them in the darkness. Why didn't they attack? There was just one answer—Lkani. Lkani was the answer to a lot of questions.

The footing became a little surer under them as the clinging muck turned into firmer stuff. Jonston realized that they would never have got through at all if Lkani had not known how to avoid the bottomless pits and suckholes that must have made up the greater part of the swamp. That Moreland had gone as far as he had was a miracle of a singularly unwelcome variety.

They were climbing now, he knew. Climbing into the Hills of the Dead where the natives buried their lifeless friends and the wind whistled through the mountains. Torrents of rain water gushed in mighty rivers down the hillsides and lightning hissed in the sky. Jonston held on.

Suddenly, it was over. They were out of it and Dale Jonston could only stand numbly and wait for feeling to return to his battered body. He stood there, soaked to the skin, and looked out at the raging storm. Gradually, he became aware of the fact that he was in a cave. Someone put a bowl of hot liquid in his cold hands and he drank it mechanically.



Lkani thought ahead and they were waiting.

The fluid was strong and warm and good, like a cross between a heavy soup and a sweet liquor. It picked him up amazingly and he began to feel almost human again.

"We haven't much time," Lkani said.

"I'm O.K.—let's go."

They started into the cave and Dale Jonston noted with surprise that the air was dry and warm. There must be some sort of a force field across the cave entrance, he reasoned. Simple natives indeed! And yet the smooth floor of the cave seemed to be completely free from

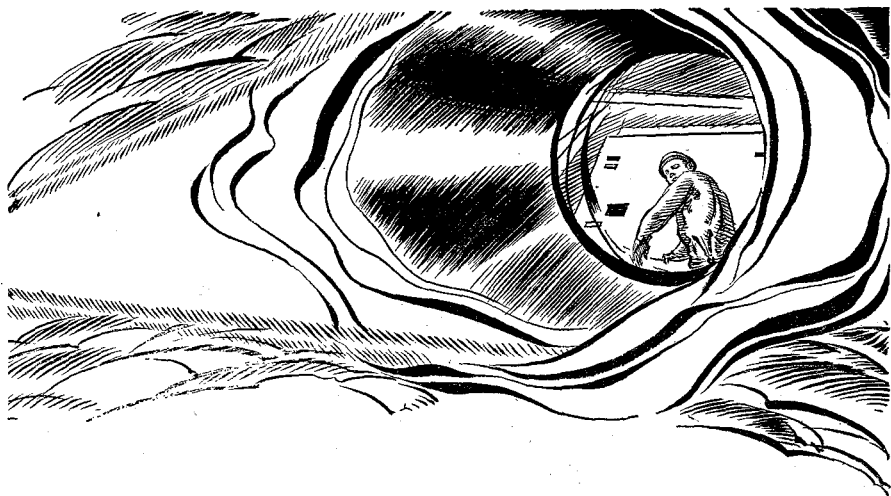
mechanical contrivances of any sort; the blue-skinned people cooked over roaring wood fires and evidently made their homes in smaller, branching caves. Force fields and caves, mind reading and a primitive social structure—Dale Jonston shook his head at the mounting paradoxes.

"Where are we going?" he asked.

"Can't explain," Lkani answered shortly. "Trying to keep the man from pulling the rods on that pile."

Coercive thought projection, Jonston's mind observed.

He followed Lkani without comment through the cave. The sounds of the storm were muted by distance now, but far ahead of him he could



hear the muffled roar of a swollen underground river. He tried not to think of Moreland at the Post—face too pale, eyes too bright, with his finger on the trigger of eternity. If that pile cut loose—

It was all up to Lkani now. Dale Jonston accepted the situation as it was, without trying to assert a meaningless authority of his own. He knew superior intelligence when he saw it and he was ready to co-operate. He followed the native tensely and kept his eyes open. Lkani, he noticed, had picked up a tubular device of some sort that looked like an uncommonly thick flashlight with a pistol grip attached.

Primitive man, Jonston thought, laughing at himself.

The sound of the river was closer now and they quickened their steps. Why are we going alone? Jonston wondered. Why don't the rest of

them come with us? A part of his mind sensed the truth: *I've got to be the one who does the job. Lkani will make it possible, but I've got to do it. Why?*

They passed a branching cave that was larger than the others and Jonston looked inside. It was brightly lighted from within and he caught a fleeting glimpse of a slim tower of silver that strained toward the dark heavens above.

A spaceship—in a cave!

Lkani went on and Jonston stayed right behind him. Abruptly, the air turned cold and moist; there was no gradation from warm to cold—it was just suddenly and precisely *cold*. There was still light in the cave, coming from a faint mineral glow in the rocks.

Jonston shivered and kept on going, his mind beginning to stagger under the strange import of the

things that he had seen. The churning roar of the river washed chillingly through the damp cave and phantom echoes shuddered among the rocks.

Time, he knew, was running out.

The river hissed by like a great serpent below them, fat and swollen with tons of rain and hurling itself angrily at the walls of its rock prison. Dale Jonston stood with Lkani and looked uneasily at the narrow ledge of sharp rock that wound along above the boiling torrent.

"That the way?" he asked, knowing the answer in advance.

Lkani nodded and swung down to the ledge, holding carefully to the metal tube. Jonston trembled in his wet clothes and followed him.

"You've got me all wrong, friend," he panted, "I'm an ETS man—not the Human Fly."

Lkani smiled and kept on going. Jonston took a deep breath and tried to cling to the slippery rocks. The churning river tumbled wickedly below them, filling the cavern with booming spray. He was cold and afraid and he felt very small. He tried to joke to himself, as men always do when they feel death at their throat. But nothing is very funny when you're walking the Last Mile.

Time ceased to be as they clawed and fought their way along the treacherous ledge. Their fingers were cut and bleeding and their exhausted muscles were numb with

fatigue. The world was the next rock, the next curve, the next inch. Below them, the black river chanted its song of hate—and waited.

Jonston gasped with relief as Lkani turned off into a cave that branched away from the river. He stood gratefully still for a long minute, getting his wind and listening to the roar of the cheated torrent. His chest ached with strain and his torn clothes were streaked with blood where he had touched them with his hands.

"Come on," Lkani said.

They ran through the comparatively dry cave, forcing their bodies as if they were something apart from them, like automatons in which their minds temporarily resided. Lkani still carried the tube in his hand and he set a murderous pace. Jonston kept up with difficulty, breathing in short, painful jerks of air. His mind was a spotty screen of black and white upon which Moreland's face was stamped in livid flame. Time—there *couldn't* be any more time.

Lkani stopped, his chest heaving. He stood rigidly with his eyes closed. Beads of sweat stood out on his forehead. Jonston watched silently, fighting to get his breath. The great river was a dark murmur behind them.

"All right," Lkani whispered. "We're directly under the pile room, and he's up there. I'll open a hole and you get him—and *don't miss.*"

Jonston set himself, his heart beating wildly. Lkani aimed the

metal tube at an angle toward the upper part of the cave wall. He set two dials very carefully and pressed the switch.

There wasn't a sound—but a spherical section of rock ceased to be. It simply wasn't there any more. Dale Jonston hurled himself into the hole and hoisted himself through.

The scene that confronted him was like a picture that he had seen many times before. He had imagined it so intensely that every detail was familiar to him. The indicators set in the lead shield were gyrating feverishly and the very air in the glaringly white room was tensely charged. Moreland crouched at the door, his too bright eyes staring out of his too white face.

He screamed when he saw Jonston and threw himself crazily at the lead shield, clawing for the damping rods. Jonston caught him with a flying tackle—and Moreland exploded like a wild thing in his arms. He shrieked and tore and lashed out with superhuman strength. Something hit Jonston on the side of the head and white lights danced in his brain.

Jonston wrenched loose somehow and fell to the floor. He rolled and got up again, sick and dizzy. Moreland was rushing in, screaming his hate, his fingers tensed like white claws. Jonston backed away, calling on reserves of power he wasn't sure he possessed.

One punch, he thought desperately. One punch is all I've got.

Moreland loomed up in front of

him and Jonston threw his punch from the heels up. It smacked into Moreland's face with a sickening crunch. The shock of the blow traveled back through Jonston's arms and went off with a white puff in his brain.

That was the last thing he remembered.

"You've been out for thirty-six hours," Lin Carlson said.

Dale Jonston looked around shakily. He was in his own bed in the Post and his body ached dully. The light from the floor lamp splashed whitely across Lin Carlson's face.

"Lkani," he said, not recognizing his own voice. "Where's Lkani?"

"He went back across the swamp after he unlocked the door of the pile room—that tunnel the natives dug caved in."

"I see," Jonston said, not seeing at all. Tunnel caved in? That was nonsense—

"Sure glad to see you awake again," Carlson smiled. "You really saved our necks, Dale. If you hadn't fixed those damping rods, we'd all be in the unhappy hunting ground for sure."

I never touched those rods, Jonston thought.

"The credit belongs to Lkani," he said.

"He's some native, I'll say."

"Yeah—some native."

"He left a note for you," Carlson said, handing him a sealed envelope. "And we've got Moreland doped to

the gills—we'll send him back on the first ship to Earth. Maybe they can do something for him."

"Everything else O.K.?"

"Guess so—except that none of us quite understands what happened. Lkani didn't do much explaining and—"

"Tell you all about it some day, Lin. Right now, I wonder if you'd go tell the cook to scare up some breakfast for me? I'm half starved."

"Will do," Carlson said, getting to his feet. "See you later."

He left the room and Dale Jonston was alone. He twisted his bruised body over in the bed and tore open the letter. His hands, he noticed, were shaking. There were two sentences on the paper:

"There was no atomic explosion—that is what counts. Stop and think and you will understand."

Dale Jonston fumbled for his pipe, filled it with fragrant tobacco, and lit it. He closed his eyes and relaxed, inhaling the smoke slowly. Lkani, he sensed instantly, had somehow planted a message in his brain. Or perhaps he was in contact now from across the swamp—

No matter. It came softly into his mind—softly but with bell-like clearness.

You are an intelligent man, the voice spoke in his mind. You cannot see two and two and fail to put them together to make four. We have gambled on your intelligence and your discretion—and we know that you will act accordingly, both for

our people and for your own.

You saw force fields and spaceships, telepathy and a tool that realigns the dimensional plane of atoms. You must have guessed that we are a part of that civilization which you know only as the Others. Much that may seem mysterious to you is not strange at all; like so many things, it is relatively simple once you know the facts.

You have had difficulty in associating what appears to be a primitive culture with an advanced civilization, but that is only because you have confused complexity with progress. Your own anthropologists have known for many years that simple cultures are often better integrated than your own, and better serve the needs of the individual. It has been a truism of your people that you have knowledge and refuse to apply it.

If you will stop and think about it, the "Time of the Terror" is quite as graphic a term as "A Psychological State of Tension Induced by Periodic Storms"—but I will not trouble you with an analysis of why we live as we do. We are happy and that, after all, is the only valid test.

We are but a tiny part of a tremendous civilization that spans the galaxy. Cultural maturity must be attained before a people can become a part of such an association—and there are many different types of civilizations involved. For example, we do not manufacture our own spaceships; our contributions are along other lines.

We have been watching Earth for centuries, waiting. Your presence here on Rohan is not entirely your own doing—it is one of a series of tests. You see the problem: a tense conflict situation with atomic energy readily available. There was no atomic catastrophe—and it was prevented by your own efforts. You asked for help and got it—and that, too, showed intelligence on your part.

You will understand, Dale Jonston, why this knowledge must stop with you. Your people are not yet ready to face the situation that exists, and unless they work their problems out for themselves they can never attain the stability that is essential for galactic co-operation. But the time is rapidly approaching—and you will live to see the day when mankind sets forth on an adventure beyond its wildest dreams.

For we are not the only civilization in the universe.

That was all.

Dale Jonston opened his eyes. His pipe had gone out and he put it aside. It was too much to assimilate all at once. He looked around his room. The floor lamp threw dark shadows on the log walls. He thrilled with knowledge.

Not the only civilization in the universe—

Beyond the Others—what?

He shook his head, suddenly conscious of a strangeness in the air.

Something was wrong.

He got out of bed and stood still,

listening. There wasn't a sound. That was it. *Silence.*

He walked shakily over to the window and pressed the button that changed the glass from opaque to clear. Mottled sunlight splashed into the room. He looked up into the sky where the massed black clouds were splitting and being forced apart by slanting rays of flame that transformed the sky into a brilliant mass of color—red and yellow and green, cold silver and warm gold, the clouds rolled by and the light came through. He opened the window and drank in the fresh, clean smell of the breeze that murmured in from the marshes.

It had been a tough climb up from Earth to the edge of forever, he thought—but it was a climb that had to be made.

He heard laughter drift up from around the Post and somewhere a guitar began to play. A rhythmic voice started an old, old song:

"Oh, I'm bound to go where there ain't no snow,

Where the sleet don't fall and the wind don't blow,

In the Big Rock Candy Mountains—"

Dale Jonston smiled happily.

"There's a lake of stew and of whisky, too,

You can paddle all around in a big canoe,

In the Big Rock Candy Mountains—"

The storm was over.

THE END

THE EDGE OF FOREVER

81

FIRST ATOMIC PILE

BY CORBIN ALLARDICE AND EDWARD R. TRAPNELL

It's perfectly true that setting up the first successful nuclear fission reactor was a triumph of technology—but human beings did it. And the story of the human triumph—of the uncertainties and hopes—is something else. This is an article—but also a great story.

Photographs from Atomic Energy Commission

It was hot as only Washington can be hot that day in September 1946 when Ned Trapnell, General Groves' top press aide, asked a question that took me three months to answer.

"Say, Corb," Ned asked, "when do you say the atomic age was born?"

"July 16th, last year when the first bomb was exploded at Alamogordo," I answered. "At least, that seems to be the most dramatic date to pin the birthday to."

"I've always thought so," Ned admitted, "but Wally Zinn—Dr. W. H. Zinn, director of Argonne National Laboratory—says the boys in Chicago want to celebrate December 2nd as the birthday—that's when they got

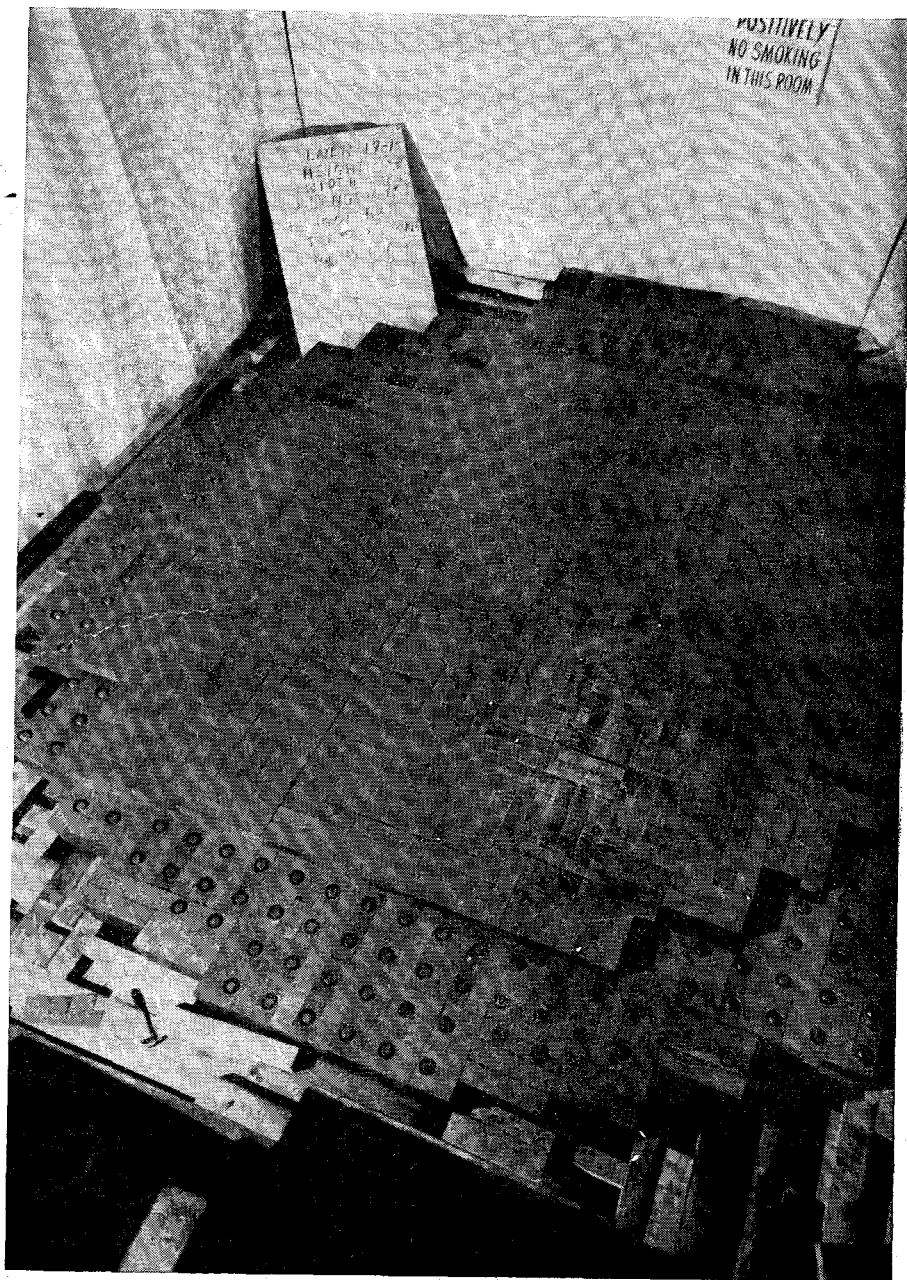
their first real chain reaction. Wally wants me to speak to General Groves about having December 2nd recognized as the significant anniversary."

"That's right; now I remember. Wasn't that in a converted squash court or something? The Smyth Report mentions the experiment and says it was very significant."

"Right. Wally is talking about a scientific meeting of some kind for December 2nd—with Fermi and the whole crew there. How about looking into it and seeing if you can work up some sort of story about December 2, 1942. It might make an interesting release."

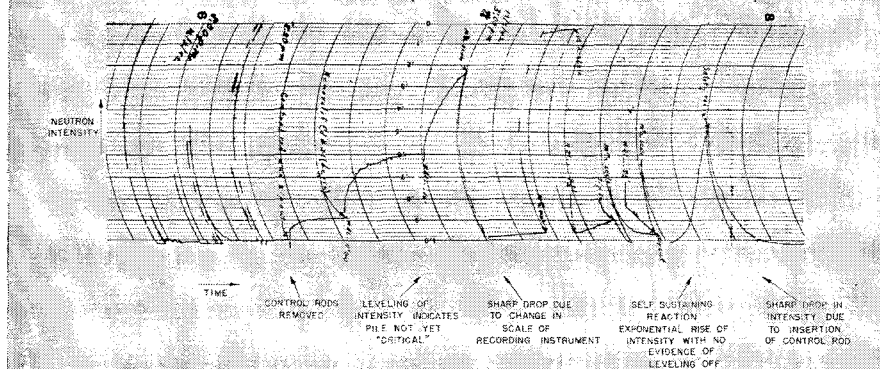
Two days later I was on my way to

First Atom Pile in process of construction. The pile was built up, layer by layer, and elaborate measurements made as each layer was added. This is the only photograph of the pile in process officially known to exist. For scale, notice the hammer in lower left. The dimensions read: Height 6' 5"; Width 21' 1"; Length 22' 4".



FIRST ATOMIC PILE

DEC. 2 1942 START-UP
OF
FIRST SELF-SUSTAINING CHAIN REACTION
NEUTRON INTENSITY IN THE PILE AS RECORDED BY A GALVANOMETER



Photostat of original record of the first self-sustaining chain reaction on Earth.

Chicago—the first of a series of trips in the next two months—to find out all I could about the atom’s birthday. The first scientist I talked to was Norm Hilberry. Dr. Hilberry, a rosy complexioned man with graying hair, sparkling eyes and a pixy sense of humor, began by saying that there was no record of just who was present at the historic first pile experiment.

“I do remember, though,” Dr. Hilberry told me, “that Al Wattenberg kept an empty Chianti bottle which some of us signed after the pile was successfully operated on December 2nd. Maybe by checking the names on the bottle and asking those who signed if they remember who else was there we can reconstruct a list of ‘players’.”

“Wait a minute,” I asked, “what

was a Chianti wine bottle doing at the first pile test?”

“Eugene Wigner (Dr. Wigner is now Professor of Mathematical Physics at Princeton) brought it under his coat—full, of course—and after we knew the pile worked he unveiled it and we all toasted Professor Fermi’s, and man’s first, chain reaction. It was good wine, too.”

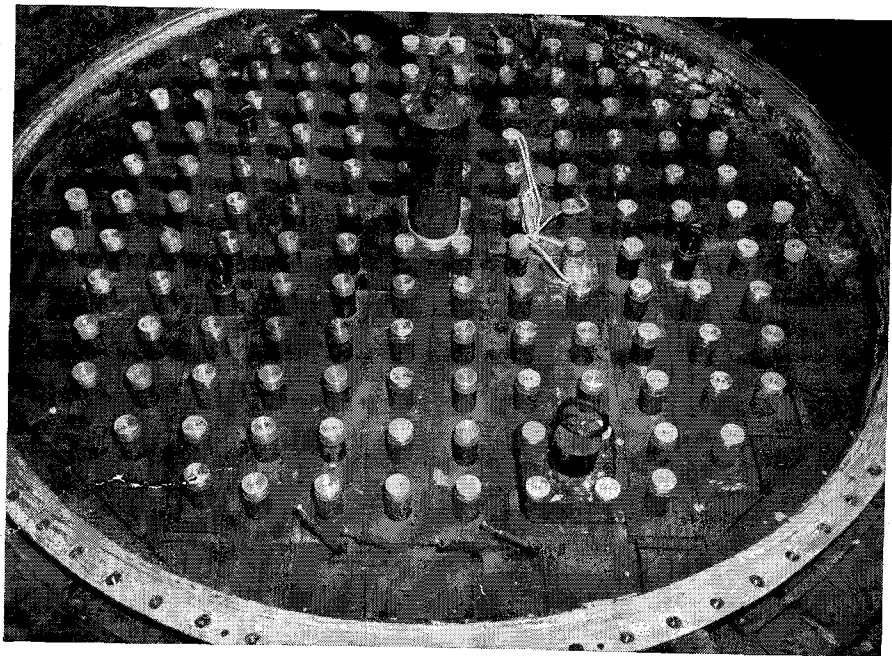
I hot-footed it over to Ryerson Hall at the University of Chicago where I found Dr. Wattenberg as he was erasing a flock of triple integrals from a classroom blackboard. I introduced myself and came right to the point. Did he still have the souvenir wine bottle that some of the December 2nd’ers signed? He thought so. Could I copy the names? Why certainly. He’d bring it from home tomorrow.

The next days found Hilberry, Wattenberg and me trying to decipher signatures that make the chicken scrawls of my physician look like A-1 Palmer Method. We finally translated some twenty names, and then got in touch with as many of these scientists as time allowed by telegraph and letter. After adding others they remembered as being present, we accepted the resulting list of forty-two names as complete.

In the next two months I interviewed about twenty of the men who

had been present at the December 2nd experiment. Each had a somewhat different recollection of what happened, due no doubt to the fact that everyone there was busy checking instruments or taking observations. But, the interview I best remember was my first with Enrico Fermi.

Fermi is a gentle featured, soft spoken, Italian-born Nobel Prize-winner. He has been called the father of the Atomic Age, and on December 2nd was midwife at its birth.



Top of the reactor core of Argonne National Laboratory's heavy water reactor is shown. The shield has been removed to show the ends of uranium rods which are suspended in a tank of heavy water. The large hole in center is the thimble which extends nearly to bottom of tank. Materials to be made radioactive are lowered into this hole. Argonne Photo 190.

"Tell me, Dr. Fermi, how did you feel when you knew your pile experiment was a success?" was the first question I asked. I suppose I expected to get some epic response like Caesar's, "I came, I saw, I conquered."

Fermi's answer is a classic of downright honesty: "I felt tired."

The next time I interviewed Fermi he was working in his laboratory at Argonne with Leona Woods Marshall. Mrs. Marshall, herself a Ph.D., is the wife of nuclear physicist Dr. John Marshall, and frequently collaborates with Professor Fermi in nuclear studies. Both Fermi and Mrs. Marshall were wearing white lab coats and it was during this interview that I noticed Fermi's habit of jotting numerical data on the back of his pocket slide rule and, after making rapid calculations, rubbing the figures out with a moistened finger-tip. It was also at this time that Fermi explained in elementary terms—top-notch people always seem to be able to explain simply—the significance of the neutron measurements shown on the trace which recorded the December 2nd experiment.

As he described the final adjustments to the pile's control rods and then the big event itself—a self-sustaining chain reaction—it was as if I were able to hear Christopher Co-

lumbus tell of sighting the New World, or some future "Italian navigator" tell of landing his spaceship on Venus.

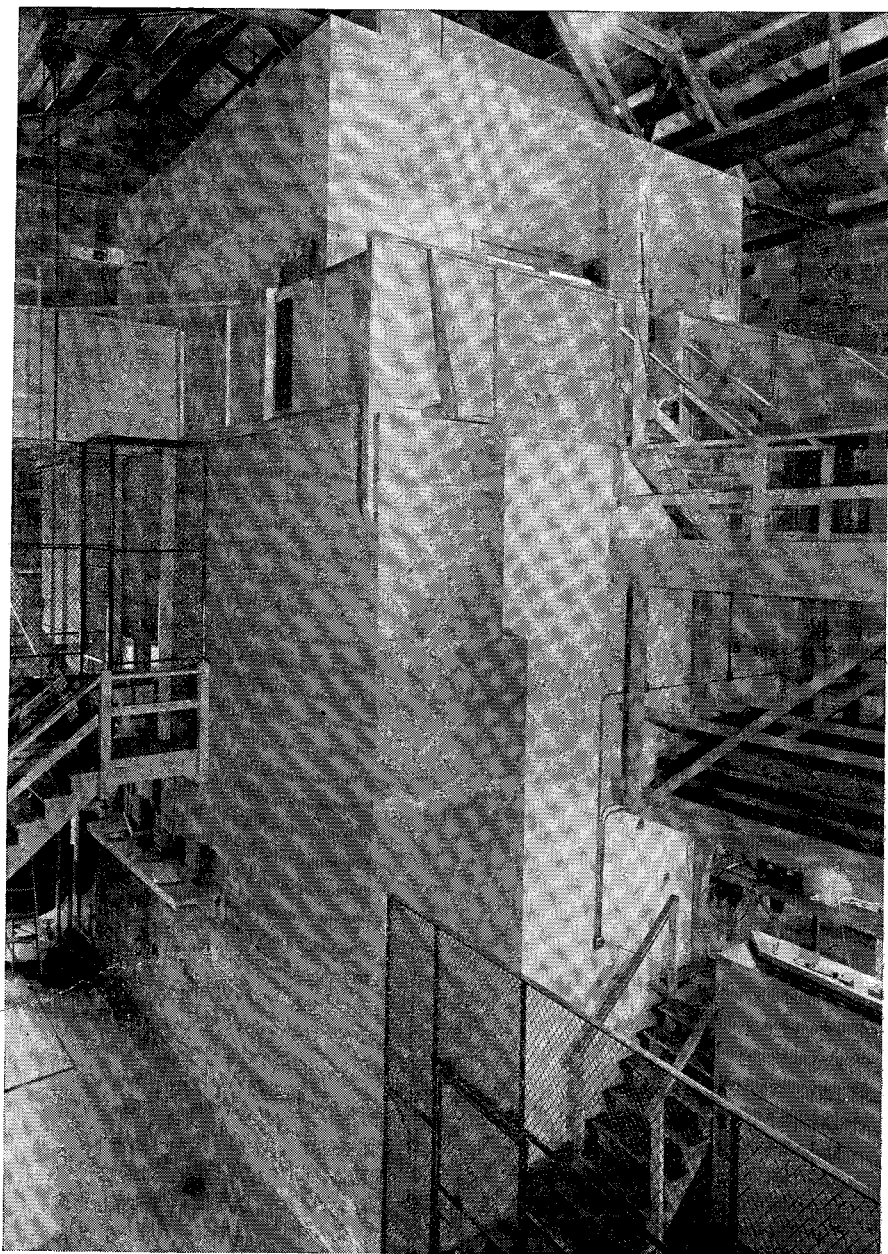
As Fermi ended his tale—told completely in a subdued voice with slight, soft, Italian undertones—I snapped back to 1946 and the story of the birth of the Atomic Age. My problem now was to reconstruct, to recapture, the moments Fermi and his colleagues had described.

Back at my typewriter in Washington, the difficulty of putting this account into government release form became clear. As November came, Ned and I saw that the December 2nd story, brimming with excitement and drama, had to have different treatment than the normal government press release style afforded.

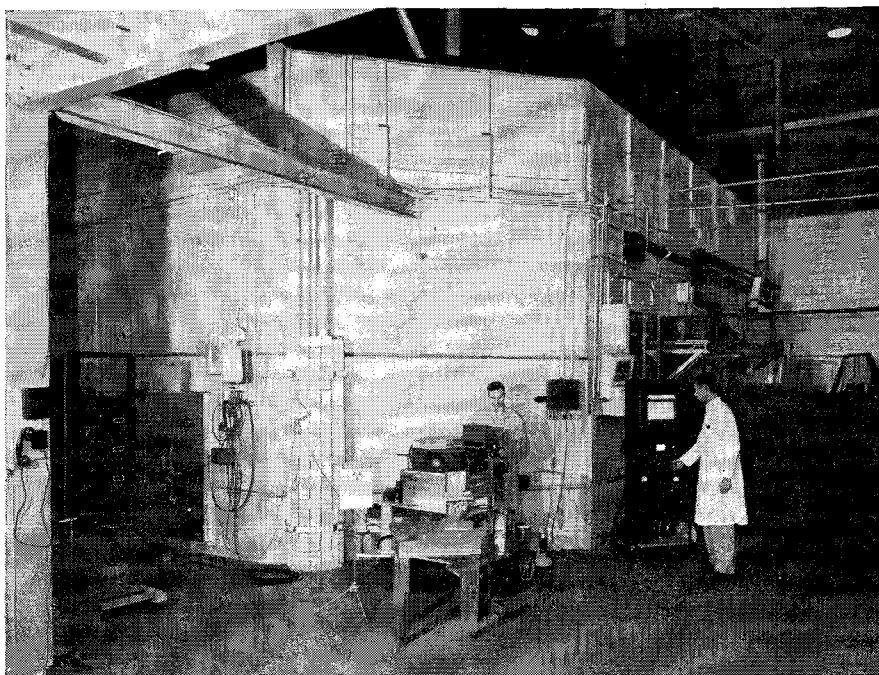
"You know, Corb," Ned said, after reading through my collection of notes on interviews and the first rough of a news release, "I think we would be justified in writing this as if we were unseen observers at the experiment—use direct quotations, personalize the whole thing. You have the facts, let's put 'em together in a story."

We did. What we wrote may not represent exactly what each man said during the experiment, but those who are quoted—and they had a chance to read our piece before release—all agree that it's a quite fair reconstruc-

The original graphite-uranium reactor, moved from Stagg Field and rebuilt is at the Argonne National Laboratory. The reactor core is a cube (20' x 22' x 21') of graphite in which fifty-two tons of uranium and uranium oxide are imbedded in a lattice-type arrangement. Five feet of concrete shields it. Laboratory on top is for housing equipment for studying neutrons.



FIRST ATOMIC PILE



The reactor core is surrounded by two feet of graphite neutron-reflector plus eight feet of concrete. The radiation escaping through the shielding is less than that found in a transatlantic airliner's cockpit. (Aircraft luminous instruments emit radiation!)

tion of what was said.

If what we wrote is a worth-while story of December 2nd, it is due to the help of Drs. H. L. Anderson, A. H. Compton, E. Fermi, N. Hilberry, H. V. Lichtenberger, L. W. Marshall, R. G. Noble, W. J. Sturm, A. Wattenberg, and W. H. Zinn; its inaccuracies or omissions are the authors'.

On December 2, 1942, man first initiated a self-sustaining nuclear chain reaction, and controlled it.

Beneath the West Stands of Stagg

Field, Chicago, late in the afternoon of that day, a small group of scientists witnessed the advent of a new era in science. History was made in what had been a squash-rackets court.

Precisely at 3:25 p.m., Chicago time, scientist George Weil withdrew the cadmium plated control rod and by his action man unleashed and controlled the energy of the atom.

As those who witnessed the experiment became aware of what had happened, smiles spread over their faces and a quiet ripple of applause could be heard. It was a tribute to Enrico

Fermi, Nobel Prizewinner, to whom, more than to any other person, the success of the experiment was due.

Fermi, born in Rome, Italy, on September 29, 1901, had been working with uranium for many years. In 1934 he bombarded uranium with neutrons and produced what appeared to be element 93 (uranium is element 92) and element 94. However, after closer examination it seemed as if nature had gone wild; several other elements were present, but none could be fitted into the periodic table near uranium—where Fermi knew they should have fitted if they had been the transuranic elements 93 and 94. It was not until five years later that anyone, Fermi included, realized he had actually caused fission of the uranium and that these unexplained elements belonged back in the middle part of the periodic table.

Fermi was awarded the Nobel Prize in 1938 for his work on transuranic elements. He and his family went to Sweden to receive the prize. The Italian Fascist press severely criticized him for not wearing a Fascist uniform and failing to give the Fascist salute when he received the award. The Fermis never returned to Italy.

From Sweden, having taken most of his personal possessions with him, Fermi proceeded to London and thence to America where he has remained ever since.

The modern Italian explorer of the unknown was in Chicago that cold December day in 1942. An outsider, looking into the squash court where Fermi was working would have been greeted by a strange sight. In the center of the

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30 by 60 foot room, shrouded on all but one side by a gray balloon cloth envelope, was a pile of black bricks and wooden timbers, square at the bottom and a flattened sphere on top. Up to half of its height, its sides were straight. The top half was domed, like a beehive. During the construction of this crude appearing but complex pile (the name which has since been applied to all such devices) the standing joke among the scientists working on it was: "If people could see what we're doing with a million-and-a-half of their dollars, they'd think we are crazy. If they knew why we are doing it, they'd be sure we are."

In relation to the fabulous atomic bomb program, of which the Chicago Pile experiment was a key part, the successful result reported on December 2nd formed one more piece for the jigsaw puzzle which was atomic energy. Confirmation of the chain reactor studies was an inspiration to the leaders of the bomb project, and reassuring at the same time, because the Army's Manhattan Engineer District had moved ahead on many fronts. Contract negotiations were under way to build production-scale nuclear chain reactors, land had been acquired at Oak Ridge, Tennessee, and millions of dollars had been obligated.

Three years before the December 2nd experiment, it had been discovered that when an atom of uranium was bombarded by neutrons, the uranium atom sometimes was split, or fissioned. Later, it had been found that when an atom of uranium fissioned, additional neutrons were emitted and

became available for further reaction with other uranium atoms. These facts implied the possibility of a chain reaction, similar in certain respects to the reaction which is the source of the sun's energy. The facts further indicated that if a sufficient quantity of uranium could be brought together under the proper conditions, a self-sustaining chain reaction would result. This quantity of uranium necessary for a chain reaction under given conditions is known as the critical mass, or more commonly, the "critical size" of the particular pile.

For three years the problem of a self-sustaining chain reaction had been assiduously studied. Nearly a year after Pearl Harbor, a pile of critical size was finally constructed. It worked. A self-sustaining nuclear chain reaction was a reality.

Years of scientific effort and study lay behind this demonstration of the first self-sustaining nuclear chain reaction. The story goes back at least to the fall of 1938 when two German scientists, Otto Hahn and Fritz Strassman, working at the Kaiser Wilhelm Institute in Berlin found barium in the residue material from an experiment in which they had bombarded uranium with neutrons from a radium-beryllium source. This discovery caused tremendous excitement in the laboratory because of the difference in atomic mass between the barium and the uranium. Previously, in residue material from similar experiments, elements other than uranium had been found, but they differed from the uranium by only one or two units of mass. The barium differed by approximately

98 units of mass. The question was, where did this element come from? It appeared that the uranium atom when bombarded by a neutron had split into two different elements each of approximately half the mass of the uranium.

Before publishing their work in the German scientific journal *Die Naturwissenschaften*, Hahn and Strassman communicated with Lise Meitner who, having fled the Nazi controlled Reich, was working with Neils Bohr in Copenhagen, Denmark.

Meitner was very much interested in this phenomenon and immediately attempted to analyze mathematically the results of the experiment. She reasoned that the barium and the other residual elements were the result of a fission, or breaking, of the uranium atom. But when she added the atomic masses of the residual elements, she found this total was less than the atomic mass of uranium.

There was but one explanation: The uranium fissioned or split, forming two elements each of approximately half of its original mass, but not exactly half. Some of the mass of the uranium had disappeared. Meitner and her nephew O. R. Frisch suggested that the mass which disappeared was converted into energy. According to the theories advanced in 1905 by Albert Einstein in which the relationship of mass to energy was stated by the equation $E = mc^2$ (energy is equal to mass times the square of the speed of light), this energy release would be of the order of 200,000,000 electron volts for each atom fissioned.

Einstein himself, nearly thirty-five years before, had said this theory might be proved by further study of radioactive elements. Bohr was planning a trip to America to discuss other problems with Einstein who had found a haven at Princeton's Institute for Advanced Studies. Bohr came to America, but the principal item he discussed with Einstein was the report of Meitner and Frisch. Bohr arrived at Princeton on January 16, 1939. He talked to Einstein and J. A. Wheeler who had once been his student. From Princeton the news spread by word of mouth to neighboring physicists, including Enrico Fermi at Columbia. Fermi and his associates immediately began work to find the heavy pulse of ionization which could be expected from the fission and consequent release of energy.

Before the experiments could be completed, however, Fermi left Columbia to attend a conference on theoretical physics at George Washington University in Washington, D. C. Here Fermi and Bohr exchanged information and discussed the problem of fission. Fermi mentioned the possibility that neutrons might be emitted in the process. In this conversation, their ideas of the possibility of a chain reaction began to crystallize.

Before the meeting was over, experimental confirmation of Meitner and Frisch's deduction was obtained from four laboratories in the United States (Carnegie Institution of Washington, Columbia, Johns Hopkins, and the University of California). Later it was learned that similar confirmatory experiments had been made by Frisch

and Meitner on January 15th. Frederic Joliot-Curie in France, too, confirmed the results and published them in the January 30th issue of the French scientific journal, *Comptes rendus*.

On February 27, 1939, the Canadian born Walter H. Zinn and Leo Szilard, a Hungarian, both working at Columbia University, began their experiments to find the number of neutrons emitted by the fissioning uranium. At the same time, Fermi, and his associates, Herbert L. Anderson and H. B. Hanstein, commenced their investigation of the same problem. The results of these experiments were published side-by-side in the April edition of the *Physical Review* and showed that a chain reaction might be possible since the uranium emitted additional neutrons when it fissioned.

These measurements of neutron emission by Fermi, Zinn, Szilard, Anderson, and Hanstein were highly significant steps toward a chain reaction.

Further impetus to the work on a uranium reactor was given by the discovery of plutonium at the Radiation Laboratory, Berkeley, California, in March, 1940. This element, unknown in nature, was formed by uranium-238 capturing a neutron, and thence undergoing two successive changes in atomic structure with the emission of beta particles. Plutonium, it was believed, would undergo fission as did the rare isotope of uranium, U-235.

Meanwhile, at Columbia, Fermi and Zinn and their associates were working to determine operationally possible designs of a uranium chain reactor. Among other things, they had to find

a suitable moderating material to slow down the neutrons traveling at relatively fast velocities. In July, 1941, experiments with uranium were started to obtain measurements of the reproduction factor (called "k"), which was the key to the problem of a chain reaction. If this factor could be made sufficiently greater than 1, a chain reaction could be made to take place in a mass of material of practical dimensions. If it were less than 1, no chain reaction could occur.

Since impurities in the uranium and in the moderator would capture neutrons and make them unavailable for further reactions, and since neutrons would escape from the pile without encountering uranium-235 atoms, it was not known whether a value for "k" greater than unity could ever be obtained.

Fortunate it was, that the obtaining of a reproduction factor greater than 1 was a complex and difficult problem. If Hitler's scientists had discovered the secret of controlling the neutrons and had obtained a working value of "k," they would have been well on the way toward producing an atomic bomb for the Nazis.

One of the first things that had to be determined was how best to place the uranium in the reactor. Fermi and Szilard suggested placing the uranium in a matrix of the moderating material, thus forming a cubical lattice of uranium. This placement appeared to offer the best opportunity for a neutron to encounter a uranium atom. Of all the materials which possessed the proper moderating qualities, graphite

was the only one which could be obtained in sufficient quantity of the desired degree of purity.

The study of graphite-uranium lattice reactors was started at Columbia in July, 1941, but after reorganization of the uranium project in December, 1941, Arthur H. Compton was placed in charge of this phase of the work, under the Office of Scientific Research and Development, and it was decided that the chain reactor program should be concentrated at the University of Chicago. Consequently, early in 1942 the Columbia and Princeton groups were transferred to Chicago where the Metallurgical Laboratory was established.

In a general way, the experimental nuclear physics group under Fermi was primarily concerned with getting a chain reaction going; the chemistry division organized by F. H. Spedding (later in turn under S. K. Allison, J. Franck, W. C. Johnson, and T. Hogness) with the chemistry of plutonium and with separation methods, and the theoretical group under E. P. Wigner with designing production piles. However, the problems were intertwined and the various scientific and technical aspects of the fission process were studied in whatever group seemed best equipped for the particular task.

At Chicago, the work on sub-critical size piles was continued. By July, 1942, the measurements obtained from these experimental piles had gone far enough to permit a choice of design for a test pile of critical size. At that time, the dies for the pressing of the uranium oxides were designed

by Zinn and ordered made. It was a fateful step, since the entire construction of the pile depended upon the shape and size of the uranium pieces.

It was necessary to use uranium oxides because metallic uranium of the desired degree of purity did not exist. Although several manufacturers were attempting to produce the uranium metal, it was not until November that any appreciable amount was available. By mid-November, Westinghouse Electric and Manufacturing Company, Metal Hydrides Company, and F. H. Spedding, who was working at Iowa State College at Ames, Iowa, had delivered several tons of the highly purified metal which was placed in the pile, as close to the center as possible. The procurement program for moderating material and uranium oxides had been handled by Norman Hilberry. R. L. Doan headed the procurement program for pure uranium metal.

Although the dies for the pressing of the uranium oxides were designed in July, additional measurements were necessary to obtain information about controlling the reaction, to revise estimates as to the final critical size of the pile, and to develop other data. Thirty experimental sub-critical piles were constructed before the final pile was completed.

Meantime, in Washington, Vannevar Bush, Director of the Office of Scientific Research and Development, had recommended to President Roosevelt that a special Army Engineer organization be established to take full responsibility for the development of the atomic bomb. During the summer, the

Manhattan Engineer District was created, and in September, 1942, Major General L. R. Groves assumed command.

Construction of the main pile at Chicago started in November. The project gained momentum, with machining of the graphite blocks, pressing of the uranium oxide pellets, and the design of instruments. Fermi's two "construction" crews, one under Zinn and the other under Anderson, worked almost around the clock. V. C. Wilson headed up the instrument work.

Original estimates as to the critical size of the pile were pessimistic. As a further precaution, it was decided to enclose the pile in a balloon cloth bag which could be evacuated to remove the neutron-capturing air.

This balloon cloth bag was constructed by Goodyear Tire and Rubber Company. Specialists in designing gasbags for lighter-than-air craft, the company's engineers were a bit puzzled about the aerodynamics of a square balloon. Security regulations forbade informing Goodyear of the purpose of the envelope and so the Army's new square balloon was the butt of much joking.

The bag was hung with one side left open; in the center of the floor a circular layer of graphite bricks was placed. This and each succeeding layer of the pile was braced by a wooden frame. Alternate layers contained the uranium. By this layer-on-layer construction a roughly spherical pile of uranium and graphite was formed.

Facilities for the machining of graphite bricks were installed in the West

Stands. Week after week this shop turned out graphite bricks. This work was done under the direction of Zinn's group, by skilled mechanics led by millwright August Knuth. In October, Anderson and his associates joined Zinn's men.

Describing this phase of the work, Albert Wattenberg, one of Zinn's group, said: "We found out how coal miners feel. After eight hours of machining graphite, we looked as if we were made up for a minstrel. One shower would remove only the surface graphite dust. About a half-hour after the first shower the dust in the pores of your skin would start oozing. Walking around the room where we cut the graphite was like walking on a dance floor. Graphite is a dry lubricant, you know, and the cement floor covered with graphite dust was slippery."

Before the structure was half complete measurements indicated that the critical size at which the pile would become self-sustaining was somewhat less than had been anticipated in the design.

Day after day the pile grew toward its final shape. And as the size of the pile increased, so did the nervous tension of the men working on it. Logically and scientifically they knew this pile would become self-sustaining. It had to. All the measurements indicated that it would. But still the demonstration had to be made. As the eagerly awaited moment drew nearer, the scientists gave greater and greater attention to details, the accuracy of measurements, and exactness of their construction work.

Guiding the entire pile construction and design was the nimble-brained Fermi, whose associates described him as "completely self-confident but wholly without conceit."

So exact were Fermi's calculations, based on the measurements taken from the partially finished pile, that days before its completion and demonstration on December 2nd, he was able to predict almost to the exact brick the point at which the reactor would become self-sustaining.

But with all their care and confidence, few in the group knew the extent of the heavy bets being placed on their success. In Washington, the Manhattan District had proceeded with negotiations with E. I. du Pont de Nemours and Company to design, build, and operate a plant based on the principles of the then unproved Chicago pile. The \$350,000,000 Hanford Engineer Works at Pasco, Washington, was to be the result.

At Chicago during the early afternoon of December 1st, tests indicated that critical size was rapidly being approached. At 4:00 p.m. Zinn's group was relieved by the men working under Anderson. Shortly afterwards, the last layer of graphite and uranium bricks was placed on the pile. Zinn, who remained, and Anderson made several measurements of the activity within the pile. They were certain that when the control rods were withdrawn, the pile would become self-sustaining. Both had agreed, however, that should measurements indicate the reaction would become self-sustaining when the rods were withdrawn, they

would not start the pile operating until Fermi and the rest of the group could be present. Consequently, the control rods were locked and further work was postponed until the following day.

That night the word was passed to the men who had worked on the pile that the trial run was due the next morning.

About 8:30 on the morning of Wednesday, December 2nd, the group began to assemble in the squash court.

At the north end of the squash court was a balcony about ten feet above the floor of the court. Fermi, Zinn, Anderson, and Compton were grouped around instruments at the east end of the balcony. The remainder of the observers crowded the little balcony. R. G. Nobles, one of the young scientists who worked on the pile, put it this way: "The control cabinet was surrounded by the 'big wheels'; the 'little wheels' had to stand back."

On the floor of the squash court, just beneath the balcony, stood George Weil, whose duty it was to handle the final control rod. In the pile were three sets of control rods. One set was automatic and could be controlled from the balcony. Another was an emergency safety rod. Attached to one end of this rod was a rope running through the pile and weighted heavily on the opposite end. The rod was withdrawn from the pile and tied by another rope to the balcony. Hilberry was ready to cut this rope with an axe should something unexpected happen, or in case the automatic safety rods failed. The third rod, operated by Weil, was the one which actually held the reaction in

check until withdrawn the proper distance.

Since this demonstration was new and different from anything ever done before, complete reliance was not placed on mechanically operated control rods. Therefore, a "liquid-control squad," composed of Harold Lichtenberger, W. Nyer, and A. C. Graves, stood on a platform above the pile. They were prepared to flood the pile with cadmium-salt solution in case of mechanical failure of the control rods.

Each group rehearsed its part of the experiment.

At 9:45 Fermi ordered the electrically operated control rods withdrawn. The man at the controls threw the switch to withdraw them. A small motor whined. All eyes watched the lights which indicated the rods' position.

But quickly, the balcony group turned to watch the counters, whose clicking stepped up after the rods were out. The indicators of these counters resembled the face of a clock, with "hands" to indicate neutron count. Nearby was a recorder, whose quivering pen traced the neutron activity within the pile.

Shortly after ten o'clock, Fermi ordered the emergency rod, called "Zip," pulled out and tied.

"Zip out," said Fermi. Zinn withdrew "Zip" by hand and tied it to the balcony rail. Weil stood ready by the "vernier" control rod which was marked to show the number of feet and inches which remained within the pile.

At 10:37 Fermi, without taking his eyes off the instruments, said quietly:

"Pull it to 13 feet, George." The

counters clicked faster. The graph pen moved up. All the instruments were studied, and computations were made.

"This is not it," said Fermi. "The trace will go to this point and level off." He indicated a spot on the graph. In a few minutes the pen came to the indicated point and did not go above that point. Seven minutes later Fermi ordered the rod out another foot.

Again the counters stepped up their clicking, the graph pen edged upwards. But the clicking was irregular. Soon it leveled off, as did the thin line of the pen. The pile was not self-sustaining—yet.

At eleven o'clock, the rod came out another six inches; the result was the same: an increase in rate, followed by the leveling off.

Fifteen minutes later, the rod was further withdrawn and at 11:25 was moved again. Each time the counters speeded up, the pen climbed a few points. Fermi predicted correctly every movement of the indicators. He knew the time was near. He wanted to check everything again. The automatic control rod was reinserted without waiting for its automatic feature to operate. The graph line took a drop, the counters slowed abruptly.

At 11:35, the automatic safety rod was withdrawn and set. The control rod was adjusted and "Zip" was withdrawn. Up went the counters, clicking, clicking, faster and faster. It was the *clickety-click* of a fast train over the rails. The graph pen started to climb. Tensely, the little group watched, and waited, entranced by the climbing needle.

Whrrrump! As if by a thunder clap, the spell was broken. Every man froze—then breathed a sigh of relief when he realized the automatic rod had slammed home. The safety point at which the rod operated automatically had been set too low.

"I'm hungry," said Fermi. "Let's go to lunch."

Perhaps, like a great coach, Fermi knew when his men needed a "break."

It was a strange "between halves" respite. They got no pep talk. They talked about everything else but the "game." The redoubtable Fermi, who never says much, had even less to say. But he appeared supremely confident. His "team" was back on the squash court at 2:00 p.m. Twenty minutes later, the automatic rod was reset and Weil stood ready at the control rod.

"All right, George," called Fermi, and Weil moved the rod to a predetermined point. The spectators resumed their watching and waiting, watching the counters spin, watching the graph, waiting for the settling down and computing the rate of rise of reaction from the indicators.

At 2:50 the control rod came out another foot. The counters nearly jammed, the pen headed off the graph paper. But this was not it. Counting ratios and the graph scale had to be changed.

"Move it six inches," said Fermi at 3:20. Again the change—but again the leveling off. Five minutes later, Fermi called: "Pull it out another foot."

Weil withdrew the rod.

"This is going to do it," Fermi said to Compton, standing at his side. "Now

it will become self-sustaining. The trace will climb and continue to climb. It will not level off."

Fermi computed the rate of rise of the neutron counts over a minute period. He silently, grim-faced, ran through some calculations on his slide rule.

In about a minute he again computed the rate of rise. If the rate was constant and remained so, he would know the reaction was self-sustaining. His fingers operated the slide rule with lightning speed. Characteristically, he turned the rule over and jotted down some figures on its ivory back.

Three minutes later he again computed the rate of rise in neutron count. The group on the balcony had by now crowded in to get an eye on the instruments, those behind craning their necks to be sure they would know the very instant history was made. In the background could be heard William Overbeck calling out the neutron count over an annunciator system. Leona Marshall (the only girl present), Anderson, and William Sturm were recording the readings from the instruments. By this time the click of the counters was too fast for the human ear. The *clickety-click* was now a steady *brrrrr*. Fermi, unmoved, unruffled, continued his computations.

"I couldn't see the instruments," said Weil. "I had to watch Fermi every second, waiting for orders. His face was motionless. His eyes darted from one dial to another. His expression was so calm it was hard. But suddenly, his whole face broke into a broad smile."

Fermi closed his slide rule—

"The reaction is self-sustaining," he

announced quietly, happily. "The curve is exponential."

The group tensely watched for twenty-eight minutes while the world's first nuclear chain reactor operated.

The upward movement of the pen was leaving a straight line. There was no change to indicate a leveling off. This was it.

"O. K., 'Zip' in," called Fermi to Zinn who controlled that rod. The time was 3:53 p.m. Abruptly, the counters slowed down, the pen slid down across the paper. It was all over.

Man had initiated a self-sustaining nuclear reaction—and then stopped it. He had released the energy of the atom's nucleus and controlled that energy.

Right after Fermi ordered the reaction stopped, the Hungarian-born theoretical physicist Eugene Wigner presented him with a bottle of Chianti wine. All through the experiment Wigner had kept this wine hidden behind his back.

Fermi uncorked the wine bottle and sent out for paper cups so all could drink. He poured a little wine in all the cups, and silently, solemnly, without toasts, the scientists raised the cups to their lips—the Canadian Zinn, the Hungarians Szilard and Wigner, the Italian Fermi, the Americans Compton, Anderson, Hilberry, and a score of others. They drank to success—and to the hope they were the first to succeed.

A small crew was left to straighten

up, lock controls, and check all apparatus. As the group filed from the West Stands, one of the guards asked Zinn:

"What's going on, doctor, something happen in there?"

The guard did not hear the message which Arthur Compton was giving James B. Conant at Harvard, by long-distance telephone. Their code was not prearranged.

"The Italian navigator has landed in the New World," said Compton.

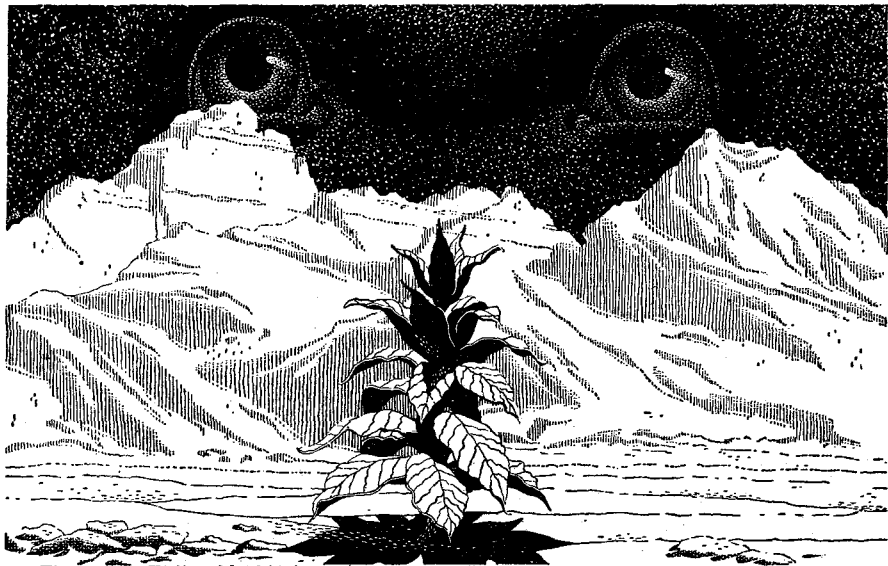
"How were the natives?" asked Conant.

"Very friendly."

LIST OF THOSE PRESENT AT
"CHICAGO PILE" EXPERIMENT,
DECEMBER 2, 1942

H. M. Agnew	G. Miller
S. K. Allison	G. Monk, Jr.
H. L. Anderson	H. W. Newson
H. M. Barton	R. G. Nobles
T. Brill	W. E. Nyer
R. F. Christy	W. P. Overbeck
A. H. Compton	H. J. Parsons
E. Fermi	L. Sayvetz
R. J. Fox	G. S. Pawlicki
S. A. Fox	L. Seren
D. K. Froman	L. A. Slotin
A. C. Graves	F. H. Spedding
C. H. Greenewalt	W. J. Strum
N. Hilberry	L. Szilard
D. L. Hill	A. Wattenburg
W. H. Hinch	R. J. Watts
W. R. Kanne	G. L. Weil
P. G. Koontz	E. P. Wigner
H. E. Kubitschek	M. Wilkening
H. V. Lichtenberger	V. C. Wilson
Mrs. L. Woods Marshall	W. H. Zinn

THE END



ICEWORLD

BY HAL CLEMENT

Third of Three parts. *The fundamental requirements for an intelligent living being are not oxygen, water, sulfur vapor or any material at all—but an immaterial vastly more necessary!*

Illustrated by van Dongen

Law enforcement agencies of the planet Sarr are becoming troubled over the appearance of a new, nameless drug. It has not been reaching the planet itself; it keeps only under extreme refrigeration, and the necessary apparatus is too bulky for easy smuggling. However, its use on spaceships within the

system indicates that only a single dose is needed to produce addiction; it is therefore possible at any time for a customs group to be enslaved, opening the planet wide to invasion by the narcotic.

Sallman Ken is asked to co-operate with the enforcement agency in locating

the source of the drug. A non-scheduled space carrier line has come under suspicion; Ken answers their advertisement for a chemical engineer—he is scientist enough to carry such a role for a time at least—and is transported in a sealed room on one of their carriers for several days. When he is finally allowed to see out, the ship is in the vicinity of a dwarf sun. Ken is informed by his employer, Laj Drai, that his job is to improve communication with the natives of one of his star's planets. Apparently the world contains two races. One inhabiting the flat, blue-tinted areas that cover most of the world's surface is hostile, since all remote-controlled torpedoes descending in these areas have been destroyed; the other, dwelling in the more rugged regions, is sufficiently friendly to have undertaken limited trade with the Sarrians. Drai's people cannot descend to the planet themselves in any suit they have been able to devise—the low temperature is too much for their engineering; the planet's temperature is actually well below the freezing point of the sulfur the Sarrians breathe. Ken accepts, with the hope that this world may prove the source of the drug. He sets to work with the aid of Feth Allmer, a mechanic in Drai's employ.

The cold planet is actually Earth and the person who has been trading secretly with the Sarrians is named Wing. He is in the habit of spending summers at his home in the Rockies northeast of Lake Pend 'Oreille, near the Montana-Idaho border; the homing transmitter of the

Sarrians, to which they direct their remote-controlled torpedoes, is on a peak a few miles to the east. His wife has a good idea of the source of their income—the Sarrians pay in platinum and iridium nuggets—as has his oldest son Donald; but thirteen-year-old Roger Wing is determined to find out what lies behind the mysterious trips of his father into the forest. On one of his attempts he is caught in the woods by nightfall a short distance west of the Sarrian transmitter.

Ken and Feth have loaded a torpedo with chemical equipment to test Earth's atmosphere. The torpedo lands within earshot of the spot where Roger is sleeping; he watches with surprise as samples of various metals are heated to incandescence in the little vessel's cargo compartment. The sodium, magnesium, and titanium burn; other metals oxide slightly or not at all. As the light of the magnesium fire dies out Roger voices his amazement, and the torpedo's microphones carry his voice to Ken and Feth far above. In the attempted conversation that follows, Ken mentions the word "Gold" knowing that that is sometimes used in trade with the natives of Earth. Misunderstanding him, Roger uses his wrist watch in an attempt to illuminate the now nearly dark cargo compartment, sees the crucible containing the still nearly molten gold, attempts to seize it, and is burned. Dropping the watch, he jumps back from the torpedo, and Ken starts the machine back toward the base on Mercury. It arrives, is

warmed to bearable temperature, and opened.

Up to this time, Ken had assumed that the natives of this part of Earth are little better than savages—that they may even take the visiting torpedoes as supernatural phenomena. However, Roger's watch puts an abrupt end to that idea. They are evidently capable of delicate machine-work, at least; and if really good communication can be set up, their own enforcement agencies may conceivably be able to help Ken with his problem. His suspicion that Draï is actually the individual he wants, and that the substance the Earth natives call "tobacco" is actually the drug he seeks, is growing steadily. He conceals the watch from Draï. He enters Draï's office during the latter's absence, and obtains data concerning Earth's location in space; but Draï's suspicions are aroused. He contaminates the air of Ken's room with tobacco, thus confirming the investigator's suspicions but rendering him a helpless addict of the drug.

Ken learns that Allmer is in the same situation; and the two determine to work together. A suit is devised as protection against Earth's frightful cold, and tested on Mars. It is successful, until Ken wades into a layer of frost; the latent heat of fusion and vaporization of water is too much for his insulation, and he barely succeeds in returning to his ship. Judging that this white material is the same as that which is visible about the poles of Earth, he decides that it is reasonably safe to visit any other region

of the planet.

Draï, satisfied that Ken is in his power because of the drug, approves the journey, particularly when Ken makes the suggestion that the tobacco Draï obtains might be an organic product which they could collect for themselves and learn to grow on Mercury. The armor is attached to the outside of a torpedo—it is too large to go inside—and Ken makes the descent, Allmer guiding the carrier down to a point near the transmitter in the Rockies. Ken lands on a mountain top and attempts to gather some local vegetation; but the temperature of his armor is sufficient to ignite everything organic that he touches. He is about to leave when he hears a human voice.

PART 3

XIV.

It was not, in the end, his own discouragement which caused the cessation of Roger's nocturnal watchings. The night on which the Sarrians tested the armor was, indeed, the last of these journeys; but this was owing to reasons beyond the boy's control. When he descended in the morning, his father met him and accompanied him outside. There he pointed out certain footprints. Then they went up to Roger's room together, and the rope came to light. Mr. Wing concluded the proceedings with a request for an explanation.

"Don't get the idea that anyone

tattled," he added. "I don't know whether you have anyone in your confidence, even. Both your mother and I saw that you were getting most of your sleep done daytimes. Well, what's the story?"

Roger never even thought of lying. The family custom of proving questionable statements on challenge had taught him, as it had the other children, to recognize evidence and forego useless denial. The only question in his mind was whether to tell or not. He knew there would be no punishment if he refused; but also, there would be no help from his father on a problem that was decidedly beyond his own abilities, and there would most certainly be no more night journeys in search of landing torpedoes. He told what had happened, with all the detail the near-eidetic memory of childhood could evoke. His father was silent for a minute or two when he had finished.

"We'll say nothing about your following Don and me," he said at last. "You were never told in so many words not to, and curiosity is a healthy trait. Of course you let yourself get caught in the woods at night without food, water or light, and that is a more serious matter in view of the fact that you're supposed to know better. However, the story being as interesting as it is, I guess we'll suspend sentence on that offense." Roger grinned.

"What would the sentence have

been?" he asked, suddenly thoughtful.

"The logical one would be restriction to the half-mile circle for a week or two. You certainly behaved like a six-year-old. Let's consider that that's hanging over your head, and go on to more immediate matters. I suppose Edie knows all about this?"

"She knows about what happened that night. Not about the times I've gone out since."

"All right. After breakfast, get her and come with me. We have a number of things to talk over."

It turned out that Don was also at the meeting. This was held in a little natural amphitheater a few yards uphill from the house, which had been fitted with split-log benches. Mr. Wing wasted no time, but told the younger children the same story he had told Donald a few days before. Then Roger repeated his tale, mostly for his older brother's benefit. Don had, of course, seen a Sarrian torpedo by this time, as he had been present when the first load of tobacco had been delivered a few days before; and there seemed to be little doubt that the structure Roger had encountered was of the same origin.

"I don't understand why they're shifting their base of operations after all these years." Mr. Wing looked puzzled. "They've been coming back to that same gadget which we think is a directional transmitter every summer since before Don was born."

"You don't really know that they

haven't landed anywhere else, though," pointed out Donald. "It just happened that Roger met one of their torpedoes. There might have been any number of others, anywhere on Earth."

"That's true, of course. Rog, you didn't find any traces of other landings on these night walks of yours, did you?"

"I'm not sure, Dad. There's a little patch of bushes all by itself on a hill-top out that way, that's been burnt over. I couldn't find any sign of a campfire, and there haven't been any thunderstorms. I thought maybe one of the things had dropped something like the thing that burned my hand, and started the fire; but I couldn't find anything of the sort. I don't really know what started it."

"I see. Then to sum up, we've been trading with creatures not native to this world for a long time; we may or may not be the only ones doing so; on at least one occasion they sent down a craft whose primary mission does not seem to have been trade."

"Unless the light that Rog saw was intended to attract attention, as it did," cut in Donald.

"In that case they would hardly have had their gold too hot to be touched. Furthermore, I've always refused gold—regular prospectors are competition enough without starting a rush of amateurs."

"We don't know that other people, if there have been any, felt the same

way. But I guess you're right about the temperature. They must have been conducting an experiment of their own, and the offer to trade was an afterthought when they heard Rog's voice."

"It was a dirty trick," commented Roger.

"It may have been unintentional. Their knowledge of our language is extremely limited, and apparently they can't see down here. Either they don't know about television or can't mount a transmitter in those torpedoes. Besides, if you came on them unexpectedly, they may have forgotten in the excitement of the moment that the gold would be hot. You said it was another container which was providing the light. However, that's a point there's not much use discussing.

"I had not planned to take this step until both Roger and Edie were older, and had had training enough to be of more help; but the matter seems to have been taken out of my control in that respect. What I want to do, and will need the help of all of you in doing, is to find out where these things are from, what sort of people are running them—and, if possible, how they work. I don't have to tell you how important that knowledge would be. I have never tried to get outside experts on the job, because, as I told Don, I was afraid they'd let curiosity overcome prudence. I don't want the torpedoes scared away by any hasty action. I'm

too old to learn a new trade, for one thing."

"Nuts!" It was Edie's first contribution to the discussion, though she had listened intently to all that had gone before.

"What are we going to do?" Roger asked, rather more practically.

"First of all, you two will come with us the next time we trade. I may take the younger kids along too, only it's quite a walk for them. You can listen in, watch, and generally see the whole thing for yourselves. After that, ideas will be in order. I was hoping, Rog, that you'd be an electronics expert by the time this happened. However, we'll use what we have."

"Maybe my trouble the other night could be put to use," Roger suggested. "If they want tobacco badly enough to pay for it in platinum and iridium, they might be in a mood to apologize."

"Supposing they realize they hurt you, and could think of a way to transmit the apology. I won't refuse an extra nugget or two if they choose to send them, but that won't be very informative."

"I suppose that's so. Well, anyway, I'm going to go over the whole neighborhood of where I saw it and where you do your trading, by daylight. If they've made any other landings in the woods, I'll find 'em—that one broke a lot of branches, and left a dent in the ground the shape of the tor-

pedo. Others, if any, would too."

"If you think it's worth doing," remarked Don. "Why should they have landed in this neighborhood? Earth's a pretty big place."

"They did once, and I bet I know why!" retorted Roger. "That transmitter is right here! If you were exploring a new world or a new country even, would you make one landing here and another five hundred miles away? You would not. You'd get to know one neighborhood first, and plant an outpost, and then spread out from there."

There was silence for two or three minutes while the others absorbed this.

"You're assuming, then," said Mr. Wing at last, "that after twenty years of mere trading, they suddenly are starting to explore? Why didn't they do it sooner?"

"Unfair question."

"True enough. All right, it's certainly a usable working hypothesis. You may go ahead with your exploring—so may Edie if she wants. I'm not sold enough on your idea to spend the effort myself, but in a day or two I'll signal for another torpedo. That will give you time to do any looking you want, I suppose?"

"Well—" Roger's recent mapping activities had given him a much clearer idea than he had formerly held just what the examining of one square mile meant. "We can look around a bit, anyway. I'm going right now, if

* no one has any real ideas. Coming, Edie?" The girl stood up silently, and followed him back to the house. Their father watched them go with some amusement.

"I wish I didn't have a nagging worry about Rog's theory," he said suddenly to Donald. "He might just be right—these creatures might be tired of paying for tobacco and they certainly know more of physical science than we do."

"They'll have a fine time looking for the living weed in this neighborhood," replied his son. "They'll do better to stay on peaceful terms."

"Just tell 'em that, will you?" murmured Mr. Wing.

Roger and his sister wasted no time. This time there was no mistake in the matter of food; they hastily prepared some sandwiches—their mother had long since resigned herself to the fact that raids on the pantry were inseparable from common-sense rules of forest life—and with a canteen of water apiece they set out eastward. Billy and Marge were playing somewhere out of sight, so there was no trouble about taking them along. Their father's description had been clear enough so that they had no trouble in finding the Sarrian transmitter, and from there the two began their search.

At Edie's suggestion they split up, she taking the southern slopes on the line back to their home and Roger

taking the northern. They agreed to keep to high ground as much as possible, and thus remain in earshot of each other most of the time. There was little point, in the time available, to look for traces in the woods; but it might be possible to sight either burned spots such as Roger had already seen or traces of disturbance in the upper branches of trees while looking from above. At any rate, more territory could be examined. Neither youngster had spent any time debating the question of whether it was better to know about a small area or guess about a large one.

Neither Roger nor Edith was on the hill where Ken landed at the time of his descent. Nature had arranged that they should be in the neighborhood, but coincidence refused to carry matters farther. However, Nature still had a trick in reserve.

Roger, until that morning, had taken more or less for granted that any future visits of the torpedo would be at night, as the first had been. His father's story had changed that idea; and since he had heard it only three or four hours before, he had not given up taking rather frequent looks at the sky. It was not too surprising, therefore, that he saw the descending torpedo.

It was nearly a mile and a half away, and he could make out no details; but he was certain it was no bird. The irregularity caused by Ken's dangling form gave just a suggestion

of oddness at that distance. Detailed or not, however, Roger never thought of doubting what it was; and with a whoop that might or might not reach his sister's ears for all he cared at the moment, he headed downhill at a breakneck pace.

For a short time he made excellent speed, the irregularity of the rocks offering no obstacle that his alert eyes and active muscles could not overcome without trouble. Then he reached the forest, and was slowed considerably. For a short distance he kept up the furious effort with which he had started; then realizing that he had at least one hill to cross and another to climb, he eased off a little.

He had wet feet, thoroughly scratched legs, and a decided shortness of wind when he reached the hilltop toward which the torpedo had seemed to be descending, some three quarters of an hour later. He had seen no sign of Edith—he had, in fact, completely forgotten her. She might have come back to mind as he paused at the top of the small mountain to gain his breath and look around for the object of his search; but as it happened, the torpedo was in sight, only a short distance down the other side. So was Sallman Ken.

Roger had seen pictures of the tremendous pressure suits which have from time to time been constructed for deep-sea exploration. The sight of Ken, therefore, did not astonish him

too much—certainly less than the sight of a Sarrian without armor would have done. The suit the scientist was wearing humanized his appearance considerably, since a human being would not have had to be too greatly distorted to get into it.

The legs, for engineering reasons, had only a single “knee,” corresponding to the upper joint of the Sarrian limb; the body was about human size, and cylindrical in shape; there were only two upper limbs. These were more flexible than a human being would have needed in a similar suit, but they at least gave no indication that the creature wearing them was controlling them with two tentacles each. The handlers at their extremities were natural enough, though more complicated than the clawlike devices the boy had seen in the diving suit pictures.

At his distance, he could not see clearly through the transparent ports in the helmet; and so for some moments he failed to realize just how unhuman the wearer of the clumsy garment was.

For perhaps half a minute, Roger simply stared; then he unloosed the yell which interrupted Ken's “embarkation.” The scientist's attention had been completely taken up with this task, and he had not seen Roger at all before the cry; after it, he saw nothing else. He himself was not facing the direction from which the sound had come, but one of the transparent

ports in his helmet was; and he was much too interested to devote attention to anything like turning the armor, after his first look at the being charging downhill toward him. He simply stood, watching with the one eye he could bring to bear. It never occurred to him for an instant that the creature might be hostile.

Roger never thought of the possibility either. His mind resembled that of Ken much too closely, in spite of the overwhelming physical differences. They simply stood facing each other—Ken finally did swing his armor around, so he could use both eyes—and silently absorbed all the details their respective optics could pick out. Each had an advantage—Roger in the fact that the light was normal for him, Ken in that the boy was not concealed in a couple of hundred pounds of metal. Roger could see the Sarrian's face now, and his attention was taken up completely with the great, wide-spread, independently movable eyes, the blank where a nose should have been, and the broad, thin-lipped, surprisingly human mouth. The silence stretched out.

It was interrupted by Feth, whose anxiety had been increasing with each second that passed after Roger's call.

"What's happened? Is anything wrong? Are you all right, Ken?" The scientist found his voice.

"Perfectly all right. We have company, as I suppose you guessed." He



began to describe Roger as completely as possible, and was interrupted within a minute by the mechanic.

"It can't be done. We'll get a television set or a camera down there if I have to invent a whole new system. Never mind describing the thing—see if you can talk to it!"

Roger had heard none of this, since Feth had not energized the speaker in the torpedo. This oversight he now rectified, and Ken's next words reached the boy clearly.

"What can I say? Suppose this one has heard about our mistake the other night—suppose it's even the same one? If I use the word 'gold' it'll either run or start fighting. I'm not afraid of it, but that certainly wouldn't help the process of getting acquainted."

"Well, you've just used the word. How did he take it? I have the main speaker on."

Ken, who had had no means of knowing that fact, cast a startled glance at Roger.

The boy, of course, had understood just the one word "Gold." He probably would have missed that, except for the fact that Ken had accentuated it as one does a foreign word; but as it was, he thought that the previous conversation had been addressed to him. He had not distinguished the two voices, and all the sounds had come from the torpedo still poised just above Ken's head.

"I don't want any of your gold—not if it's like the last batch!" Again

only one word was understood by the listener. Ken grew hopeful. Maybe this creature hadn't heard, or maybe they had completely misinterpreted the sounds he and Feth had heard during the atmosphere test.

"Gold?" he asked.

"NO!" Roger shook his head negatively and backed away as he gave the emphatic answer. The first gesture meant nothing to the watching Sarrian, but the second seemed clear enough.

"Did you get that last sound of his on record, Feth? Judging by his actions, that's the negative in their language. No gold!" he addressed the last two words after a brief pause.

Roger relaxed visibly, but still spoke emphatically.

"No gold, no platinum—I have no tobacco." He spread empty hands and turned out his pockets, giving the Sarrian scientist a clue he had been waiting for on just how much of his covering was artificial.

"Point to things and name them!" Feth cut in from above. "How else can you learn a language? This chatter sounds as silly as anything I've ever heard!"

"All right—only remember, I can see as well as hear. That makes a bit of difference. If you expect any results, keep quiet; how's this thing going to tell who's talking? It all comes from the same loud-speaker. I'll call you when I want to hear from you."

Feth gave no answer to this very sound point, and after waiting a minute Ken began to follow the mechanic's suggestion.

Since Roger had been thinking of exactly the same thing, he caught on at once, and thereby gave the Sarrian a higher opinion of human intelligence than his conversations with Laj Drai had caused him to hold previously. The English words for rock, tree, bush, mountain, cloud, and the numbers up to ten were learned in short order. A few verbs were managed easily enough. At this point operations seemed likely to be suspended, and Roger was rather relieved to have the subject changed by a distant hail.

"My gosh! I forgot all about Edie! She must think I fell off a cliff or something!" He turned in the direction from which the faint voice seemed to be coming, and put all the strength of his lungs into an answering hail. His sister heard it and responded; and ten or fifteen minutes of lung strain brought her to the scene. She seemed a little dubious about approaching Ken at all closely, to Roger's surprise.

"What's the matter with you? He just wants to talk, as far as I can see."

"Haven't you got burned again?"

"No; why should I?"

"Can't you feel the heat?"

Oddly enough, Roger hadn't. He had never come closer than about fifteen feet to the scientist. The radiation from the armor was easily de-

tectable at that distance without being uncomfortable, but he simply had not noticed it in the press of other interests. For Edith, whose strongest impression of the aliens had been derived from her brother's experience of a few nights before, it was the most prominent characteristic of the thing standing before them.

With the matter brought to his notice, Roger approached the alien more closely, and extended a cautious hand toward the metal. He stopped it more than a foot away.

"My gosh, he certainly is hot. Maybe that's what caused the trouble—they never thought the gold would burn me. Do you suppose that's it?"

"Maybe. I'd like to know how it can live when it's that hot, though. So would Dad. He ought to be here anyway. Had I better go tell him, while you keep the thing here?"

"I don't know how I'd keep it. Besides, it would be awful late by the time he got here. Let's try to make a date for tomorrow." He turned back to Ken without waiting for Edie's rather sensible question, "How?"

Actually the "how" proved not too difficult. Time is an abstract quantity, but when it is measured by phenomena like the apparent movement of the sun it can be discussed in signs quite clearly enough for practical purposes. Ken understood without difficulty by the time Roger had finished waving his arms that the two natives would

return to their present location shortly after sunrise the following day. The scientist was just as glad to break off the interview, since his feet were now quite numb with cold. He resumed the task of fastening himself to the hovering torpedo, and the children, turning back for a last look as they reached the trees, saw the odd-looking assemblage of suit and carrier drifting upward with ever-increasing velocity. They watched until it had dwindled to a speck and vanished; then with one accord they headed for home.

XV.

Mr. Wing was not merely interested; he was enthralled by the youngsters' report. He was sensible enough to realize that nothing any of his family had done could possibly be responsible for the aliens' starting to make personal exploration of Earth, but the fact that they were doing so seemed likely to be very helpful to his plans. The evening meal consisted very largely of conversation, for all attempts to keep the details from any of the family were abandoned. Mrs. Wing, of course, had known everything from the beginning; Roger and Edie had been pretty well briefed that morning; but Billy and Marge lacked both specific information and basic knowledge to appreciate the situation. Their questions tended to break up the general train of thought, but only Roger showed any impatience. Since

even he did not dare become openly contemptuous of their ignorance, the general tone of the conversation remained peaceful, and several important decisions were made.

"It seems to me," Mr. Wing said, "that these things—maybe we can think of them as people, now that we have some idea what they look like—must at last have some scientists on the job. I can't even guess at the reason for the delay—"

"Look at an astronomical photo of the Milky way some time, and you might guess," cut in Don.

"Reason or no reason, the fact itself may be useful. There will be both explorers and apparatus coming down, beyond reasonable doubt; and they must expect to lose a certain amount of the latter. I don't mean to encourage dishonesty in my offspring, but if we could acquire some of that apparatus long enough to perform dissection I would be very pleased."

"I take it you are no longer afraid of scaring them off?" Mrs. Wing stated rather than asked.

"No. Whether they continue trading or not is out of my hands—it will probably depend on the results that their scientists get. I am not worried; they obviously want tobacco badly, and I doubt very much if it grows on any other planet. I could be surer of my ground, of course, if I knew what they wanted it for. I used to think they smoked it as we do, but this knowledge of their normal tempera-

ture makes that sound a trifle unlikely.

"But back to the original point. Anyone who talks to them from now on might well suggest that another transmitter be brought down, so they can home on this house. I see no point in walking five or six miles out and the same distance back just for a daily conversation. Incidentally, Rog, I'm wondering whether we mightn't have made a better impression if we'd tried learning their words for things instead of teaching them ours."

"Maybe. I didn't think of that."

"How about the trading, Dad?" asked Don. "Are you going to keep it up as usual, or try to get these investigators to take our stuff?" His father considered for a moment.

"I think we'd better stick to the old routine," he said finally. "We have no assurance that the traders and scientists are in with each other, and it would be a pity to disappoint our customers. Perhaps, when we go to keep this date tomorrow, you'd better go on to the transmitter and give the signal. You'd better carry a pack of cigarettes with you; normally, of course, they're two or three days answering, but if they should be in with the science crowd they may be a lot closer at the moment. You'd better be prepared, in case they answer at once."

"You mean I'd better stay by the transmitter all day, if necessary?"

"Well—no, not that. Hang around

for a while, and then come back to where we'll be. We can keep an eye in the right direction in case another torpedo comes down—it can't be more than a couple of miles in a straight line, so we stand a fair chance of seeing it."

"All right. I signal, and everybody talks, with emphasis on suggesting that another communicator be brought down—always supposing either party learns enough of the other's language to get any such idea across." Don shifted the subject suddenly. "Say, Dad, I just had an idea. You say it doesn't always take the same length of time between the signal and the arrival of the torpedo?"

"That's right. Never less than two days, never much more than three."

"Could you give me any specific signaling dates, with the time of arrival? The more the better. I think I can do something with them."

Mr. Wing thought for a moment. "Some, anyway. I can remember those of the last couple of years pretty well, and probably some odd ones from earlier years if I try. What's your idea?"

"I'd rather not tell until I'm a little more certain of it. Let's have what you can recall."

With the aid of the family, who were able to supply clues on his dates of absence—a diary kept by Edie was very helpful—about two dozen of the dates were fixed with sufficient accuracy to satisfy Don. He immediately

went up to his room, carrying the notes he had taken.

From that point the conversation drifted by imperceptible degrees into pure fantasy, and by bedtime a number of wonderful pictures had been drawn about the home life of the fiery visitors. Little Margie's was the most interesting, if the least accurate.

Sallman Ken, however, was wasting no time on fantasy. He had not yet worked out a really detailed course of action, but certain ideas were gradually taking shape in his mind as he worked.

The moment he entered the *Karella* and had emerged from his bulky armor, he went into a close conference with Feth. Lee was present at first, even following them to Ken's quarters where the scientist began; but a glance of understanding passed between Ken and Feth, and the conversation took a remarkably abstruse turn. It had just enough meaning to give the impression that matters of highly advanced physics and chemistry were being covered, in connection with the problem of keeping the seeds—if any—in the soil samples alive and healthy.

For a few minutes it looked as though Lee were going to stay and take it, but Feth suddenly had the inspiration to ask the pilot's opinion of occasional matters. After a little of this, Ordon Lee drifted back to his control room. "He's not stupid," Feth

said, looking after his retreating form, "but he certainly lacks confidence in his education! Now, what did you want to keep from Draï?"

"It has occurred to me," Ken said, "that our employer is going to want to hear everything that goes on on Planet Three, as soon as we are in halfway decent communication with the natives. I have some vague ideas about the uses to which those creatures can be put, and I'd rather not have Draï listening in to all our conversations. Since at the moment there's no way of preventing that, I'd like to know whether it might not be possible to connect me up with that speaker on the torpedo *without* having everything audible up here as well. It would be best, I suppose, if I could turn your contact on and off at will, so that he'll hear enough to keep him from getting suspicious."

"I suppose it could be done, all right," the mechanic said slowly. "I'm afraid it would take more work than it's worth, though. Wouldn't it be a great deal simpler to take another set down with you in the torpedo? You already have means for tuning both transmitter and receiver in the armor, so you could switch from one set to the other whenever you pleased."

"Wouldn't they miss the extra set?"

"Not unless Draï starts paying a great deal more attention to the technical supplies than he has in the past."

"All right, let's do it that way. Now, let's see. I already suggested suspending the armor vertically instead of horizontally from the torpedo, so I can be carried around instead of having to lug that hardware against extra gravity, didn't I?"

"Yes. That will be easy enough."

"It will have another good point, as well. The only discomfort I've felt so far on that planet has been in my feet, in spite of what we feared. This way we can keep them off the ground, so they don't lose so much by conduction."

"The only other thing I had in mind had to do with torpedo control. Could a unit be made small enough for me to carry, so I could move myself around down there instead of having to tell you where I want to go?"

Feth frowned at this suggestion. "I thought of that, too, while I was trying to keep the torpedo near you this time," he said. "Frankly, I doubt it—not that the set could be made small enough, but that I could do it with the materials I have at hand. Still, I'll look into the possibility when we get back to One. I take it you have no objection to Drai's hearing about these last two suggestions?"

"Of course not. They ought to keep him happy. I suppose it would be too much to hope that he'd take a trip down there himself, once we showed it was safe enough?" Feth smiled broadly at the scientist's suggestion.

"It would take a better psycholo-

gist than either of us to endue him with that much trust in his fellows, I fear. Besides, what good would it do? We wouldn't gain anything by leaving him there, pleasant as the idea sounds, and there'd be no use trying to threaten him, since he'd never dream of keeping any inconvenient promises you might wring out of him."

"I didn't really expect much from the idea. Well, with the other matter understood, I suppose we'd better take those samples back to One before they freeze, and get a vivarium knocked together. If we can grow anything at all, it ought to keep Drai quiet for a little while."

The torpedo which had transported Ken and his specimens had been allowed to drift to the edge of the repeller field as soon as he had detached himself from it. Feth now returned to the control room and began to monitor the little vessel, holding it close against the hull of the large ship so that it would be dragged along in the *Karella's* drive fields; and Lee, at Ken's request, headed sunward once more. A thousand miles from the surface of Mercury the torpedo was cast loose again, and Feth eased it down to a landing near the caves—a televisior had been set up there some time since, and he was able to guide the landing with the aid of this. He arranged matters so that about three feet of the torpedo's nose was in sunlight, while the rest was in the shadow of a large

mass of rock. That, he judged, should maintain somewhere near the right temperature for a few hours at least.

As soon as the *Karella* was grounded, he and Ken adjourned at once to the shop. There a metal case about a yard square and two feet high was quickly assembled. Feth very carefully welded all seams and tested them against full atmospheric pressure. A glass top was provided, sealed in place with a silicone vacuum wax that was standard equipment on any spaceship; this also checked out against a pressure equivalent to an earthly barometric reading or twelve hundred fifty millimeters of mercury. A second, similar case large enough to enclose the first was under construction when Draï appeared. He had evidently noticed at last that the ship was back.

"Well, I understand from Lee that you actually talked to a native. Good work, good work. Did you find out anything about how they make their tobacco?"

"We haven't learned their language too well yet," Feth replied with as little sarcasm as he could manage. "We were operating on a slightly different line of investigation." He indicated the partly constructed vivarium. Draï frowned at it, as though trying to gather its purpose. "It's a small chamber where we can reproduce Planet Three's conditions, we hope; more or less of an experiment. The larger one goes outside, and we'll maintain a vacuum between the two.

Feth says one of the sulfur hexafluoride refrigerators he knocked together years ago will get the temperature low enough, and we got enough of the planet's air to fill it a couple of times at their pressure."

Draï looked puzzled still. "But isn't it a little small for one of the natives? Lee said you'd described them as nearly five feet tall. Besides, I didn't hear about these plans at all."

"Natives? I thought you wanted us to grow vegetation. What good would a native do us here?"

The master's face cleared. "Oh, I see. I didn't know you'd picked up vegetation already. Still, now that I think of it, it mightn't be a bad idea to have a native or two. If the race is at all civilized, they could be used for a really stupendous ransom in to-facco—and we could use them in the cave, once it was conditioned, to take care of the tofacco and harvest it. Thanks for the idea."

"I don't know just how intelligent the natives are, as yet," replied Ken, "but I don't think they're stupid enough to walk into any sort of cage we might leave open for them. If you don't mind, I'll leave that as a last resort—we're going to have trouble enough getting our soil and seeds from their present containers into this thing without exposing them either to our atmosphere or to empty space. It would be a hundred times worse getting a native into one of those caves."

"Well, you may be right. I still think it would get us more tofacco, though."

"I'm sure it would, if they are at all civilized. I don't see why you're complaining about that, though—you're getting it cheap enough now, goodness knows."

"I don't mind the price—it's the quantity. We only get a couple of hundred cylinders a year—one of Three's years, that is. That doesn't let us operate on a very large scale. Well, do what you think best—provided you can convince me it's best, too." He left on that note, smiling; but the smile seemed to both Feth and Ken to have a rather unpleasant undertone.

Feth looked after him a little uneasily, started to return to the job in hand, stopped once more, looked rather apologetically at Ken, and then went after Draï. The scientist remembered that Feth's last dose of the drug had come some time before his own.

That set him to wondering about when he himself could expect to feel the craving. Feth had said the interval was five or six Sarrian days—which were about thirteen Earthly hours in length. About half a day had been consumed after his first recovery in general talk, checking of the big suits, and traveling out to Three; rather more than a day in the actual tests and the meeting with which they had culminated; another half day since. Looking into the future, at

least a full day must pass before the planned meeting with the natives of Three. No one could tell how long that would last, but apparently he had a couple of days' leeway in any case. He stopped worrying and turned his attention back to the partly completed vivarium.

He was not an expert welder but the specimens waiting patiently two thousand miles away would only last so long, and he did not know how long Feth would be incapacitated. He took the torch and resumed work on the outer case. He had learned from watching Feth how the testing equipment was used, and was pleasantly surprised when his seams proved airtight. That, however, was as far as he could go; the mechanic had made no written plans, and Ken had no idea of his ideas on the attachment of the various refrigerating and pumping mechanisms. He stopped work, therefore, and devoted his mind to the problem he had mentioned to Draï—how to transfer the samples to the beautiful little tank after it was completed.

He spent some time trying to invent a remote-controlled can opener before the solution struck him. Then he kicked himself soundly for not having thought of it before—his double-kneed legs gave him a noticeable advantage in that operation. After that he relaxed until Feth returned, coming as close to sleep as his race ever did.

The mechanic was back in less than four hours, as a matter of fact. He

seemed to be in fairly good shape; the tofacco apparently had few visible after-effects, even after years of use, which was a comforting thing to think about.

Ken showed him what had been done on the vivarium during his absence, and Feth expressed approval. He looked a little disappointed, however, at hearing the scientist's plan for stocking the device; as it turned out, he had had one of his own.

"I don't know why we were fools enough to get the specimens before we had a place to put them," Ken said. "We run the risk of ruining them in the cans, and have the transfer problem. We'd have been a lot smarter to make this thing first, and take it down to Three's surface for stocking on the spot. Why didn't we?"

"If you want an answer to that, we were probably too eager to make the trip," was the plausible answer. "Are you going to forget about the specimens we have, then?"

"We might check their temperatures. If those are still reasonable, we might as well take them back to Three and make the transfer there. It will be interesting to see how the seeds, if any, stood their trip—not that anything will be proved if they don't come up."

"You could make a microscopic check for anything resembling seed," Feth suggested, forgetting the situation for a moment.

"Do I cook the specimen or freeze the observer?" queried the scientist in an interested tone.

Feth did not pursue the matter. Instead, he turned back to his work, and gradually the vivarium took shape under his skilled tentacles. Both the refrigerator and the pump were remarkably tiny devices, each solidly attached to a side of the boxlike affair. Their controls were simple; an off-on toggle for the pump, and a thermostat dial for the refrigerator.

"I haven't calibrated that," Feth said, referring to the latter. "I'm mounting a thermometer inside where it can be seen through the lid, and you'll just have to fiddle with the knob until it's right."

"That's all right—for supposedly haywire apparatus, you certainly turn out a factory job. There's nothing to apologize for that I can see."

There were several hours yet to go before they were actually due at the meeting place on Planet Three. They loafed and talked for a while, Ken's plan coming gradually into more definite shape as they did so; they discussed the peculiarities of the Planet of Ice. Feth looked through his stock cabinets and reported that there was nothing he could turn into a portable control set so that Ken could handle his own torpedo. It was his turn to kick himself when the scientist suggested that he *wire* contacts to the controls—Ken did not *insist* on send-

ing the impulses by radio. Thirty minutes later a torpedo was sitting in the shop with a long cable extending from a tiny opening in its hull, and ending in a small box with half a dozen knobs studding its surface. Ken, manipulating the knobs, found no difficulty in making the projectile do whatever he wanted.

"I guess we're even in the matter of overlooking the obvious," he said at last. "Had we better be getting ready to go?"

"I suppose so. By the way, since you can't read the torpedo's instruments, maybe you'd better let me navigate you to the ground. Then you can do what you please."

"That would be best. I certainly could not judge either distance or speed at three thousand miles from the surface."

They donned spacesuits, and carried their apparatus out to the *Karella*. The vivarium they left in the air lock, since it was going to have to be fastened to the torpedo anyway; but Lee found it there a little later and delivered a vitriolic comment on people who obstructed the exits from a spaceship. Ken humbly carted the box inside by himself, Feth having gone up to the control room to direct the newly modified torpedo to its cradle.

They were ready to go, except for one thing, and neither of them realized the omission. It was brought home to them only a minute before

the planned take-off time, when another spacesuited figure glided from the air lock of the station to that of the ship. Lee waited, apparently unsurprised; and a moment later Laj Draï entered the control room.

"We may as well go, if all your apparatus is on board," he said.

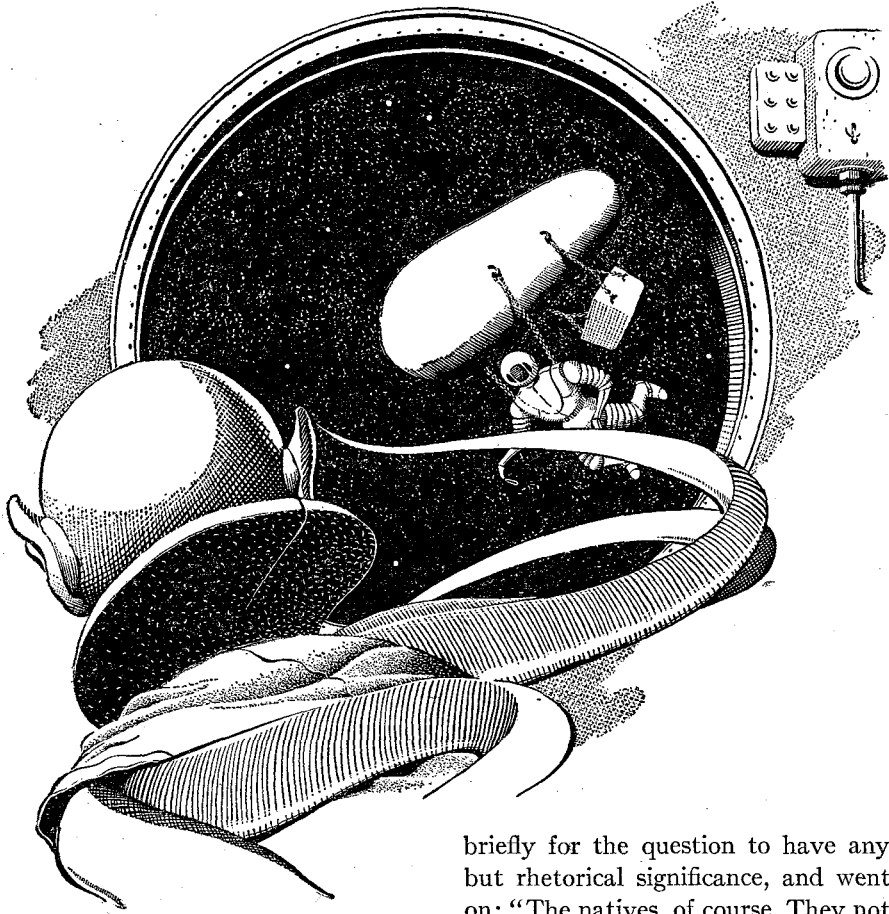
Without comment, Ken nodded to the pilot.

XVI.

Ken paused halfway into his armor to wave all four tentacles in expostulation.

"If you don't think I know what I'm talking about, why did you hire me?" he asked. "I'll get and grow plants for you as fast as I can. Our tank is only so big—there are growths down there that wouldn't fit in this ship, whether you believe it or not. I don't know any better than you what tofacco looks like when it's growing—I'm not even as sure as you seem to be that it's a plant. Just get out of your head the idea that I'm going to pack plants into this case until they have no room to breathe, and try to develop a little patience. It took two thousand years to explore Sarr, and the exploring was a darn sight easier than this!" He resumed the task of sliding into his metal shell.

"You'll do what you're told, Mr. Ken. I don't care how you do it, as I said before; but if we're not growing tofacco in a reasonable time, some-



one's going to be awfully sorry."

Ken's response was slightly muffled, as only his head was now protruding from the suit. "That, of course, you can do; I can't stop you. However, if you'll let me do this my own way, I honestly think things will go faster. Use your head—after all who does know this planet?" He paused too

briefly for the question to have any but rhetorical significance, and went on: "The natives, of course. They not only know the planet, they presumably know where the tofacco can be obtained, since they sell it to you. You'll have to work hard to convince me that there's any better way of learning what we want to know than getting the information from the natives."

"But it takes so long to learn a language!"

"True. It also takes quite a while to explore two hundred million square miles of territory, even if you count out the three quarters of it that seems to be flatland—and you can't really do that; these natives may be on good enough terms with the flatlanders to get the tofacco from them by trade. How about that? I understand you had your fill of exploring the flatlands quite a while ago—what was it, nineteen out of nineteen torpedoes lost, or twenty out of twenty? The percentage was embarrassing in either case."

"But suppose they don't want us to learn where it can be obtained? They might be afraid we'd get it ourselves, instead of paying them for it."

"That would not be too stupid of them. Sure, they may suspect just that. I never denied that a certain amount of tact would be needed. If you don't think I can exercise it, I repeat—do it yourself. We have more suits. I want to go down anyway, to study the place, but come right along—the torpedo will carry you and me and the tank easily enough!"

"I may not be a genius, but I'm not completely insane. I'll be there by proxy. If I don't like your tact, you needn't bother to come back."

"Don't you want the suit? I thought they were expensive," Ken said sweetly, and pulled the massive helmet into place with a clang.

Feth, who had been listening in, dogged the piece in place. He was just

a trifle worried; he himself had not talked to Draï like that for years, and still retained unpleasant memories of the last time he had done so. He knew, of course, the purpose behind Ken's attitude; the scientist wanted to annoy Draï sufficiently so that he would not suspect more than one thing at a time. That one thing was to be exactly what Ken wanted. Feth admitted to himself that that part of the conversation had been well handled. Nevertheless, he was not too sure he liked the expression on Laj Draï's face as that individual draped himself within easy earshot of the radio.

His attention was shifted from the matter as Ken called in from the air lock, reporting that he was attached.

"Let me out of here with my own controls, and move around a bit while I'm close enough to judge results," he finished. "I'd better get the feel of this thing while I have just inertia for trouble, and before there's weight as well."

"Sound enough," Feth approved, and took his tentacles from his own controls. One eye remained on the indicators, while the other sought the nearest port. In a few seconds the cigar-shaped bit of metal came into view, darting this way and that, swinging the clumsy figure of the armored scientist from a point near its bow and the rectangular box of the vivarium a few feet farther aft—it, too, was too large to go into the cargo

compartment. Ken seemed to be having no trouble in controlling the sloppy-looking assembly, and presently signified that he was ready for the dive.

"All right," Feth replied, "I have it. Be sure all your own controls are neutral—they're not cross-connected, and impulses will add algebraically. By the way, *all* the stuff is in the cargo compartment."

The other torpedo with the first batch of samples had been salvaged from its lonely perch on Mercury, and Laj Drai knew that; so Feth hoped he would not notice the slight accent on the "all." The mechanic had placed the extra radio in with the other objects, but had done so at the last moment and had had no time to tell Ken about it. He hoped the fellow knew how to operate the set.

Ken, as a matter of fact, had not realized what Feth was implying. He was much too occupied in bracing his nerves for the descent that had been so hard on them the previous time. He succeeded better on this occasion, largely because he was able to keep most of his mind on the problems that would be facing him after he was down. They were numerous enough.

He had little trouble finding the scene of the previous meeting, though Feth did not succeed in lowering him exactly over it. He was, he realized, early; the sun was barely up. All to the good. He reported his arrival to Feth to make sure; announced that he

was resuming control, and went to work.

His first step was to guide the torpedo downhill to the edge of a fairly extensive patch of plant growth. Before doing anything else, he made sure that the patch was isolated; the reaction of the vegetable matter of this world to hot metal had impressed him strongly, and he had a good imagination. Then he lowered the carrier until the vivarium was touching the ground, and detached the clumsy box. The double lids opened without difficulty—Feth had allowed for the probable effect of low temperature on the metal hinges—and set to work.

The samples of earth came speedily from the cargo compartment, and were dumped into the box—all at one side. Using a strip of metal he had brought along for the purpose, Ken leveled out the dark pile into a layer some three inches deep and a foot wide along one side of the container; then he began to use the strip as a crude shovel. Tiny bushes, patches of moss, and other growths were pried out of the ground, the scientist carefully refraining from allowing his armor to contact them and laying the strip down to cool at frequent intervals. He investigated the widely varying root systems, and carefully dug an extra allowance of soil from the spot where each plant had been removed, so that there would be a sufficient

depth in the box beneath it. One by one he transferred his specimens to the vivarium, placing them much too close together to have pleased a human gardener but setting them firmly into the soil so that they stood up as they had before. Once or twice he looked longingly at larger bushes, but gave up. They were too tall, and a brief investigation showed that their roots were too long.

He had covered perhaps two of the six square feet he had to fill when the Wings arrived. Roger and Edie were noticeably in advance of the rest; the two youngest would probably have been close behind them if the scene had not been so far from home. As it was, they had begun to get a little tired, and arrived at the same time as their parents.

Ken did not hear them coming; the microphone in the torpedo was not as sensitive as it might have been, and this time Roger did not call as soon as he saw the scientist. Instead, the children came as close as they dared, trying to see what he was up to. That proved obvious enough, but it was only after his curiosity was satisfied on that point that Roger gave an audible greeting.

"I see you're here early."

"Why didn't you tell me they were coming?" snapped the voice of Laj Draï from the speaker.

"I didn't see them; I've been working," replied Ken quietly. "Now, if you expect us to get anywhere with

communication, kindly keep quiet. They have no means of telling when I'm the one who's talking, and extra sounds will just confuse them." He fell silent, and watched solemnly as the rest of the human beings arrived.

The size of Mr. and Mrs. Wing surprised him a little; it took him some seconds to decide that the individuals he had seen first were probably children. The adults were more impressive, if one was impressed by mere size; Ken decided that either one would outweigh the average Sarrian by fully a quarter, assuming that they really filled their queer clothing and had flesh of comparable density. There was something a little more commanding about the manner of the older natives, also; a dignity and seriousness of purpose which he now realized had been decidedly lacking in the immature specimens. For the first time, Ken really thought of the natives of Earth as possibly civilized beings.

Certainly the actions of the largest one suggested a well disciplined mind. Mr. Wing wasted little time. He seated himself in front of Ken, pulled out a notebook in which he had already noted the words Roger claimed to have taught the alien, and checked through them. He looked up at Ken as he pronounced each; the scientist responded by pointing to the appropriate object. Satisfied that these words were understood, the man promptly embarked on a language lesson with a singleness of purpose

and efficiency of execution that had Ken regarding him as a fellow being long before they were in real communication. This was not accomplished at once, but it took far less time than many people would believe possible. As any proponent of Basic English will agree, most everyday matters can be discussed quite easily with a vocabulary of less than a thousand words. The present situation was not quite everyday in any sense of the term, but between Mrs. Wing's sketching ability and the willingness of the children to illustrate practically any actions required, progress was quite satisfactory to both parties.

Since Ken had stood in the same place throughout the lesson, he had warmed up the rock around his feet; consequently it was fully three hours before he felt the first warning ache of cold. When he did, however, he suddenly realized that he had done nothing toward the filling of his specimen box since the natives had arrived; and waiting courteously until Mr. Wing had finished an explanation, he indicated the earth. The man nodded, and pointed to the ground beyond.

Ken had paid no attention to the actions of the smallest children since shortly after the lesson had started; he had judged that they were playing, as the children of his own race did. Now he was startled to see spread out on the rock at a little

distance from the case, several score plants of assorted shapes and sizes. Apparently the youngsters had seen what he was doing, and decided to help. With growing surprise, he discovered that there were no duplicates among the specimens. The race must really have brains; he had not seen either of the adults give instructions.

With an oral expression of gratitude which he was sure must be lost on them, he began clumsily placing them in the box with the aid of his metal strip. As he picked up the first, he pointed to it with his free hand and said, "Word!"

All understood his meaning, and Roger replied, "Fern."

After watching his clumsy actions for a moment, Mr. Wing waved him away from the box, and put the children to work. Ken watched them with tremendous interest, for the first time realizing what an efficient prehensile organ the human hand could be. The deft fingers of the girls in particular were setting the plants firmly in the earth at a rate and with an ease he himself could not have managed even without the handicap of armor and temperature difference. As each was picked up, a name was given it. It did turn out afterward that the same name had been used over several times in many cases for plants that bore either a merely superficial resemblance or none at all. It took him some time to solve that one, though he already knew that the

native language had both particular and generic terms.

A very few minutes were required to cover the base of the box with neatly set plants; and not once had Ken heard the word that would have meant so much to the listening Draï. He himself was just as satisfied; the mention of "tofacco" by a native in a place where Draï could have heard it would have put a serious crimp in Ken's now rapidly maturing plans.

In spite of his having taken the cans containing the earlier specimens from the cargo section of the torpedo, it was not until he was putting the empty containers back that Ken saw the other radio Feth had placed there. For a moment he was irritated both with himself and the mechanic, since by then he had forgotten the latter's words at the time of Ken's departure; then he decided that it might be for the best. If Draï had been listening ever since the start of the language lesson, he should by now be pretty well convinced that Ken was not up to any funny business. There had been no breaks to make him suspicious.

While these thoughts were passing through his mind, Mr. Wing was also doing some thinking. It seemed fairly evident that the alien—they had not yet learned each other's name—was on the point of departure. This trip had been a pleasant enough outing for the family, it was true; but a daily repetition would be too much of a

good thing, and there were more objects at their home which could be used in language instruction as well. It seemed, therefore, that it might be worth while to make the attempt he had suggested earlier to the family—persuading the aliens to land closer to the house. In consequence, when Ken turned from his task of replacing the empty cans and fastening the sealed vivarium back in place, he found the largest native facing him with a neatly drawn but quite unintelligible diagram in his hand and an evident desire to transmit intelligence of some sort.

It took four or five minutes to make clear exactly what the map represented, though Ken got the general idea after a few seconds. Scale was the principal difficulty. At last, however, the alien understood—he spent two or three minutes describing the map in detail to Feth, first, so that it could be studied and reproduced later—and then said, "Yes," to Mr. Wing.

"Tomorrow—one day after now—*here*," the man reiterated, and Ken nodded his head—he had not been too surprised to find that visual signs supplemented the spoken language of these creatures.

"Here." He indicated the same spot as well as he could with a handler, and the paper turned brown before he hastily snatched it away. Then he remembered something else. "Not tomorrow. Not one day after now. Two

days." Mr. Wing frowned.

"Not tomorrow?"

"No. Two days. Go now; cold." And Sallman Ken turned, took the extra radio from the cargo compartment, placed it on the ground, said, "Carry!" and addressed himself to the task of attaching himself to the torpedo once more. He had detached himself, in spite of his original plan, when he found that he could not reach the cargo compartment while chained to the hull of the carrier.

The native mercifully said nothing as he completed this task. As a matter of fact, Mr. Wing was too dumfounded at this turn of events to say anything; and even the children wondered how he had done it. Ken rose into the air amid a dead silence, until the two youngest children remembered their training and shrilled, "Good-by!" after the vanishing form. He barely heard the words, but was able to guess at the meaning.

Back at the *Karella*, his first care was to get the vivarium inside. He had already evacuated the space between the walls by opening a small valve for a time during the journey through space; now he started the refrigerator, and refused to take his eyes from the inside thermometer until he had satisfied himself that all fluctuation had ceased. Then, and then only, did he start going over the tape record with Feth to make sure he remembered the hundred or so words he had been

taught during his brief dive. Laj Draï, rather to Ken's surprise, forbore to interrupt, though Feth said he had listened carefully during the entire stay on the planet. During this session, Ken managed to tell the mechanic what he had done with the radio, and the latter agreed that it had been a wise move. There was now no need to fear a casual check on the contents of the torpedo by Draï or Lee.

It seemed that Ken had been more convincing than he had expected, in his speech to Draï just before leaving. He had been a little surprised when the boss had failed to interrupt him after his return; now he found that Draï had been itching to do just that, but had been afraid of putting himself in the wrong again. The moment the conference between Ken and Feth came to an end, he was at the scientist's side, asking for an eyewitness account to supplement what he had heard on the radio.

"I really need a camera to give a good idea of appearances," Ken replied. "I seem to have been wrong about their size; the ones I saw before appear to have been children. The adults are a trifle bulkier than we are.

"I don't think the language is going to be difficult, and it looks as though this group, at least, is very co-operative." He told about the help he had received in making the plant collection.

"I was looking at that," said Draï.

"I don't suppose any of those things is what we're after?"

"No, unless they use different names for the living plant and the product. They named each of these to me as they set them in, and you'd have heard as well as I if they'd said 'tofacco' once."

Drai seemed thoughtful for a moment before he spoke again. "Children, eh? Maybe if you can work with them and get rid of the adults you could find things out more easily. They should be easier to fool."

"Something like that crossed my mind, too," Ken said. "Perhaps we ought to make a few more collection boxes to take down; I could give them to the kids to fill while I was having another language lesson, and then when they came back I'd have a good excuse to talk it over with each in turn. Something might very well crop up if the parents don't interfere."

"Parents? How do you know?"

"I don't, of course; but it seems likely. But what do you think of the idea?"

"Very good, I should say. Can you get enough boxes for all the children ready by their next morning?"

"I'm not going down that soon. I was making allowances for what Feth told me was the effect of tofacco on the system, and thought I might not be able to make it."

Drai paused long enough to do some mental arithmetic. "You're probably

right. We'll have to go back to One to get your dose, too; I somehow can't bring myself to keep the stuff around where it might fall into the wrong hands." He smiled, with the same ugly undertone that was making Ken hate the drug runner a little more each time he saw him.

XVII.

"Dad, will you kindly tell me just how you worked that?" Don stared at the Sarrian radio, which was all that was visible of the aliens by the time he got back from giving the trade signal.

Roger chuckled: "He didn't work it. He spends all afternoon teaching the thing to talk English, and just as it's going it turns around and puts this on the ground. 'Carry' it booms, and takes off. What do you suppose it is, Dad?"

"I can't possibly be sure until he comes back. It may be a piece of apparatus he intends to use on his next visit; it may be a gift in return for your aid with the plant collection. I think we'd best take it home, as he seemed to want, and do nothing at all to it until he comes back."

"But if he's not coming back until the day after tomorrow—"

"I know curiosity is a painful disease, Rog; I suffer from it myself. But I still think that the one who'll come out ahead in this new sort of trading is the one who steps most cautiously

and keeps his real aims up his sleeve the longest. We're still not certain that this scientific investigation isn't aimed at just one end—to relieve them of the need for paying us for tobacco. After all, why did this fellow start with plants? There are lots of other things he might have shown interest in."

"If he's as different from our sort of life as he seems to be, how would he know that tobacco is a plant?" countered Roger. "It certainly doesn't stay unburned long enough at his temperature to let him look at the crumbs with a microscope or anything, and a cigarette doesn't look much like a plant."

"That's true," his father admitted. "Well, I only said we don't *know* he hasn't that up his sleeve. I admit it doesn't seem likely."

Curiously enough, Ken thought of one of those points himself before the next visit; and when he descended in the clearing by the Wing home with four collecting boxes attached to his torpedo, the first thing he did was to make clear he wanted minerals in one that was not equipped with refrigeration apparatus. Pointing to another similarly plain he said, "Thing—good—hot—cold." The older Wings looked at each other for a moment; then Edith spoke.

"You mean anything that stays good whether it's hot or cold? Stuff that you don't have to keep in a refrigerator?"

There were too many new words in that sentence for Ken, but he took a chance. "Yes. Hot, good." He was still drifting a foot or two from the ground, having so arranged the load this time that he could detach it without first freeing himself. Now he settled lightly to the ground, and things began to happen.

The ground, like most of that in evergreen forests, was largely composed of shed needles. These had been cleared away to some extent around the house, but the soil itself was decidedly inflammable. Naturally, the moment Ken's armored feet touched it a cloud of smoke appeared, and only lightninglike action in lifting himself again prevented its bursting into flame. As it was, no one felt really safe until Roger had soaked the spot with a bucket of water.

That led to further complications. Ken had never seen water to his knowledge, and certainly had never seen apparatus for dispensing apparently limitless amounts of any liquid. The outside faucet from which the bucket had been filled interested him greatly; and at his request, made in a mixture of signs and English words, Roger drew another bucketful, placed it on the flat top of one of the cement posts at the foot of the porch steps, and retreated.

Ken, thus enabled to examine the object without coming in contact with anything else, did so at great length; and finished by dipping a handler cau-

tiously into the peculiarly transparent fluid. The resulting cloud of steam startled him almost as much as the temporary but intense chill that bit through the metal, and he drew back hastily. He began to suspect what the liquid was, and mentally took off his hat to Feth. The mechanic, if that was all he really was, really could think.

Eventually Ken was installed on top of an outdoor oven near the house, the specimen boxes were on the ground, and the children had disappeared in various directions to fill them. The language lesson was resumed, and excellent progress made for an hour or so. At the end of that time, both parties were slightly surprised to find themselves exchanging intelligible sentences—crude and clumsy ones, full of circumlocutions, but understandable. A faint smile appeared on Mr. Wing's face as he realized this; the time had come to administer a slight jolt to his guest, and perhaps startle a little useful information out of him. He remembered the conversation he had with Don the night before, and felt quiet satisfaction in the boy—the sort of satisfaction that sometimes goes to make a father a major bore.

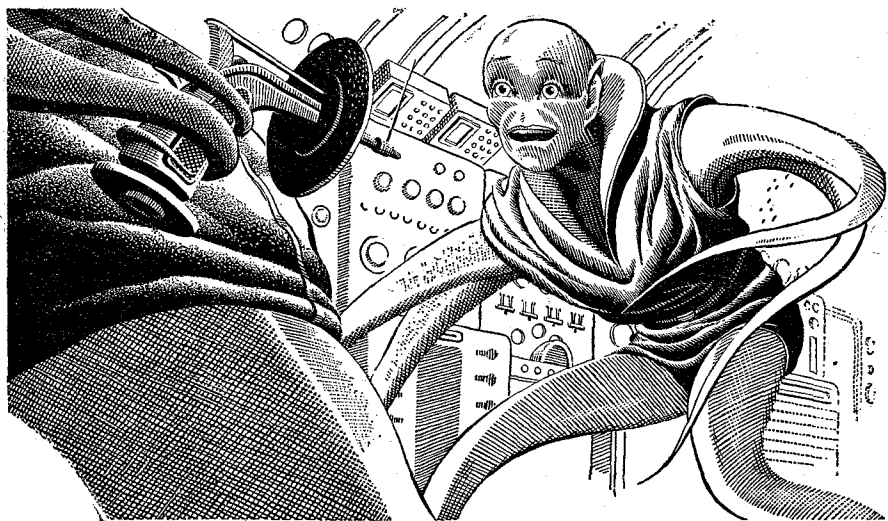
"You didn't have too many times, Dad," his son had said, "but there were enough. It ties in with other things, anyway. The intervals between signaling and the arrival of the trading torpedo have been varying in a period of just about a hundred and twenty

days, taking several years into account. Of course, a lot of those 'periods' didn't have any trading occur, but the period is there; first two days, then three. That hundred and twenty days is the synodic period of Mercury—the length of time it takes that planet to catch the Earth up on successive trips around the sun. I remembered Mercury's position when we studied it this spring, and did some figuring; your short times came when it was closest to us, the long ones when it was on the other side of the sun, about twice as far away. Those torpedoes seem to be coming from there at about one and a quarter G's of acceleration." Mr. Wing, though no physicist, understood this clearly enough. The concept had been publicized sufficiently in connection with airplanes.

He had looked over Don's figures, which were easy enough to follow, and agreed with his results; and the boy had, at his request, drawn a diagram of the orbits of inner planets of the Solar System showing the current positions of the planets themselves. This he now had in his pocket.

The word "home" had just been under discussion, more or less as a result of chance. Mr. Wing had made the concept reasonably clear, he believed; and it seemed to him that the time had come to put one of his cards on the table.

He began by waving an arm to encompass the whole horizon. "Earth,"



he said. The Sarrian repeated the word, but without any gesture of his own suggesting that he understood. The man repeated the word, stamping on the ground as he did so; then he took a new page in the notebook and made a sketch of the planet as he thought it would appear from space. As a final illustration, he molded a sphere from a lump of modeling clay which had been found in the playroom and had already been put to good use. Then he pointed to the sphere, drawing, and the ground, repeating the word after each in turn.

Ken understood. He proved it by scratching a picture of his own on the ground, reaching as far as he could over the side of the oven and using his strip of metal. It was a perfectly recognizable drawing of the sun and

orbits of the first three planets. He knew he might be exceeding the local knowledge of astronomy, but the fact that the native seemed to know the shape of his world was encouraging.

Mr. Wing promptly pulled out Don's diagram, which was substantially the same as Ken's except that Mars' orbit and position were shown. He spent some minutes naming each of the planets, and making the generic name clear as well. Then they spent some more time in a sort of game; Ken added Jupiter and Saturn to the diagram, in an effort to find out how much astronomy the human being knew. Mr. Wing named those, and added Uranus, Neptune and Pluto; Don, who had made no contribution up to this point, made a correction in the orbit of Pluto so that it crossed

that of Neptune at one point, and began adding satellites at a furious rate. They took the burst of Sarrian speech that erupted from the speaker as an indication of the alien's surprise, and were gratified accordingly.

Ken was surprised for more reasons than one.

"Drai, if you're listening, these folks are not any sort of savage. They must have a well developed science. They seem to know of nine planets in this system, and we only knew about six; and there are an awful lot of moons one of them is busy telling me about right now—he's even put two with Planet Four, and we didn't notice any. They either have space travel or darned good telescopes."

"We haven't seen a spaceship here in twenty years," Feth's voice reminded him.

Ken made no answer; Mr. Wing had started to talk again. He was pointing to Planet Three on his own diagram, and repeating the name he had given it.

"Earth—my home." He indicated himself with one hand to emphasize the personal pronoun. Then he moved the finger to the innermost world. "Mercury—your home." And he pointed to Sallman Ken.

He was a little disappointed in the reaction, but would not have been had he known how to interpret Sarrian facial expressions. The scientist was dumfounded for fully ten seconds;

when he did regain control of his voice, he addressed the distant listeners rather than the Earthman.

"I'm sure that you will also be interested in knowing that he is aware we come from Planet One. I believe he thinks we live there, but the error is minor under the circumstances."

This time Drai's voice responded. "You're crazy! You must have told him yourself, you fool! How could he possibly have learned that without help?"

"I did not tell him. You've been listening and ought to know. And I don't see why I should be expected to explain how he found out; I'm just telling you what's going on here at the moment."

"Well, don't let him go on thinking that! Deny it! He knows too much!"

"What's wrong with that?" Ken asked, reasonably enough.

"Suppose they do have space travel! We don't want them dropping in on us! Why—I've been keeping this place a secret for twenty years."

Ken forbore to point out the flaws in that line of reasoning. He simply said:

"Not knowing how certain they are of their fact, I think a denial would be foolish. If they are really sure, then they'd know I was lying; and the results might not be good."

Drai made no answer to that, and Ken turned back to the Earthman, who had been listening uncomprehendingly to the conversation.

"Mercury. Yes," the Sarrian said.

"I see. Hot," replied Mr. Wing.

"No. Cold." Ken paused, seeking words. "Little hot. Hot to you. Hot to"—he waved a sleeve of his armor in a wide circle—"plants, these things. Cold to me."

Don muttered to his father, "If he regards Mercury as too cold for comfort, he must come from the inside of a volcano somewhere. Most astronomers are satisfied that there's no planet closer to the sun, and he didn't show one on his diagram, you'll notice."

"It would be nice if we knew just how hot he liked it," agreed the older man. He was about to address Ken again in the hope of finding out something on this point when a burst of alien speech suddenly boomed from the torpedo's speaker. Even to Ken, it carried only partial meaning.

"Ken! This—" Just those two words, in Feth's voice; then the transmission ceased with the click that accompanies a broken circuit. Ken called Feth's name several times into his own microphone, but there was no response. He fell silent, and thought furiously.

He suspected from the fact that the natives were simply looking at him that they realized something had gone wrong; but he did not want to worry about their feelings just then. He felt like a diver who had heard a fight start among the crew of his air pump,

and had little attention for anything else. What were they about, up there? Had Draï decided to abandon him? No, even if the drug runner had suddenly decided Ken was useless, he would not abandon a lot of expensive equipment just to get rid of him.

For one thing, Ken suspected that Draï would prefer to see him die of drug hunger, though this may have been an injustice. What then? Had Draï become subtle, and cut off the transmitter above in the hope that Ken would betray himself in some way? Unlikely. If nothing else, Feth would almost certainly have warned him in some fashion, or at least not sounded so anxious in the words he had managed to transmit.

Perhaps Draï's distrust—natural enough under the circumstances—had reached a point where he had decided to check personally on the actions of his tame scientist. However, Ken could not imagine him trusting himself in armor on the surface of the Planet of Ice no matter what he wanted to find out.

Still, there was another way of coming down personally. Lee would not like it, of course. He might even persuade his employer that it was far too dangerous. He would certainly try. Still, if Draï really had the idea in his mind, it was more than possible that he might simply refuse to listen to persuasion.

In that case, the *Karella's* shadow might fall across them at any mo-

ment. That would fit in with Feth's attempt to warn him, and its abrupt interruption. If that were actually the case, he need not worry; his conscience was clear, and for all that was going on at the moment Draï was perfectly welcome to look on until his eyes froze to the ports. There had been no sign of tofacco anywhere, although the native children had been coming back at frequent intervals with new specimens for the boxes and had named them each time. He himself had not done a single thing in furtherance of his plan.

He had just relaxed with this realization firmly in mind when the native who had been doing most of the talking produced and lighted a cigarette.

Mr. Wing had had no intention of doing anything of the sort. He had a pretty good idea of the value placed by these creatures on tobacco, and he did not want to distract the scientist from what might prove a valuable line of talk. As a matter of fact, he would have been perfectly satisfied to have the creature assume that it was someone else entirely who did the trading. Habit, however, defeated his good intentions; and he was only recalled from his speculations on the nature of this new interruption by the realization that he had taken the first puff.

The Sarrian had both eyes fixed on the little cylinder—an unusual event in itself; usually one was roving in a way calculated to get on the nerves

even of someone like young Roger. The reason seemed obvious; Mr. Wing could imagine the alien running mentally over the list of things he had brought with him, wondering what he could trade for the rest of the pack. He was closer to being right than he should have been.

That line of thought, however, was profitless, and no one knew it better than Ken. The real problem of the moment was to get the infernal stuff out of sight before Draï arrived—if he were coming. For a moment Ken wondered if the other radio, which he had seen lying on the porch when he arrived, could be put to use in time. Common sense assured him that it could not; even if he could persuade one of the natives to bring it and tow the torpedo out of earshot, he certainly could not make his wish clear in time. He would have to hope—the cylinder was vanishing slowly, and there was a chance that it might be gone before the ship arrived. If only he could be sure that the receiver as well as the transmitter aboard the spaceship had been cut off!

If Draï were still listening, the silence of the last few seconds would probably make him doubly suspicious. Well, there was nothing to be done about that.

As it happened, there was plenty of time for the cigarette to burn out, thanks to Ordon Lee. Feth had tried to give his warning the instant he real-

ized what Drai was thinking; and the other's lashing tentacles had hurled him away from the board and across the control room before he could finish. When he had recovered and started to return, he had found himself staring into the muzzle of a pistol, its disk-shaped butt steadied against the drug runner's torso.

"So the two of you *are* up to something," Drai had said. "I'm not surprised. Lee, find the carrier of that torpedo and home down on it!"

"But sir—into Three's atmosphere? We can't—"

"We can, you soft-headed field-twister. That tame brain of mine stood it for three hours and more in a suit of engineering armor, and you want me to believe the hull of this ship can't take it!"

"But the ports—and the outer drive plates—and—"

"I said *get us down there!* There are ports in a suit of armor, and the bottom plates stood everything that the soil of Planet Four could give them. And don't talk about risk from the flatlanders! I know as well as you do that the hull of this barrel is coated even against frequency-modulated radar, to say nothing of the stuff these things have been beaming out—I paid for it, and it's been getting us through the System patrol at Sarr for a long time. Now punch those keys!"

Ordon Lee subsided, but he was quite evidently unhappy. He tuned in the compass with a slightly hopeful

expression, which faded when he found that Ken's torpedo was still emitting its carrier wave. Gloomily he applied a driving force along the indicated line, and the gibbous patch of light that was Planet Three began to swell beyond the ports.

As the board flashed a warning of outside pressure, he brought the vessel to a halt and looked hopefully at his employer. Drai made a downward gesture with the gun muzzle. Lee shrugged in resigned fashion, switched on the heaters in the outer hull, and began feeling his way into the ocean of frigid gas, muttering in an undertone and putting on an I-told-you-so expression every time a *clink* told of contracting outer plates.

Feth, knowing he would get no further chance at the radio, glued his attention to one of the ports. One of Drai's eyes did likewise, but no change appeared in his expression as the evidence began to pile up that Ken had been telling the truth. Great mountains, hazy air, green vegetation, even the shiny patches so suggestive of the vast blue plains where the flatlanders had downed the exploring torpedoes; all were there, as the scientist had said, dimly illuminated by the feeble sun of this system but clearly visible for all that. Feth, heedless of the gun in Drai's hand, suddenly leaped for the door, shouting, "Camera!" and disappeared down the corridor. Drai put the gun away.

"Why can't you be like those two?"

he asked the pilot. "Just get them interested in something, and they forget that there's anything in the universe to be afraid of." The pilot made no immediate answer; apparently Draï expected none, for he strolled to the port without waiting.

Then without looking up from his controls the pilot asked sourly: "If you think Ken is interested in his job and nothing else, why are you so anxious to check up on him all of a sudden?"

"Mostly because I'm not quite sure whose job he's doing. Tell me, Lee, just who would you say was to blame for the fact that this is the first time we're landing on this world which we've known about for twenty years?"

The pilot made no verbal answer, but one eye rolled back and met one of his employer's for a moment. The question had evidently made him think of something other than frost-bite and cracked plates: Laj Draï may not have been a genius, as he had been known to admit, but his rule-of-thumb psychology was of a high order.

The *Karella* sank lower. Mountain tops were level with the port now; an apparently unbroken expanse of green lay below, but the compass pointed unhesitatingly into its midst. At five hundred feet separate trees were discernible, and the roof of the Wing home showed piecemeal among them. There was no sign of Ken or his torpedo, but neither being in the control room doubted for an instant that this

was the house he had mentioned. Both had completely forgotten Feth.

"Take us a few yards to one side, Lee. I want to be able to see from the side ports. I think I see Ken's armor—yes. The ground slopes; land us uphill a little way. We can see for a fair distance between these plants."

The pilot obeyed silently. If he heard the shriek of Feth, echoing down the corridor from the room where the mechanic was still taking pictures, he gave no sign; the words were rendered indistinguishable by reverberation in any case. The meaning, however, became clear a moment later. The sound of the hull's crushing its way through the treetops was inaudible inside; but the other token of arrival was quite perceptible. An abrupt cloud of smoke blotted out the view from the port, and as Laj Draï started back in astonishment a tongue of flame licked upward around the curve of the great hull.

XVIII.

Feth was not the only one who called to the pilot to hold off. Ken, realizing only too clearly that the hull of the vessel would be nearly as hot as his own suit in spite of its superior insulation, expressed himself on the radio as he would never have done before his pupils; but of course no one on board was listening. Mr. Wing and Don, guessing the cause of his excitement, added their voices; Mrs. Wing, hearing the racket, appeared at a win-

dow in time to see the glossy black cylinder settle into the trees fifty yards above the house. No one was surprised at the results—no one outside the ship, at least.

Don and his father raced at top speed for the stable, where the portable fire pumps were kept. Mrs. Wing appeared on the porch, calling in a fairly well controlled voice, "Don, where are the children?" This question was partially answered before either man could make a response, as Margie and Billy broke from the woods on opposite sides of the clearing, still carrying plants which they had forgotten to drop in their excitement.

"Daddy! See the fire!" The boy shrilled as soon as he saw his father.

"I know, Billy. Both of you go with your mother, start the pump, and help her spray everything near the house. I don't think the fire will come downhill with the wind the way it is, but we mustn't take chances."

"Where are Roger and Edith?" Mrs. Wing asked the younger children.

"They were going to get rocks for the fire-man," Margie replied.

Their mother was obviously unhappy about the matter, but she took the youngsters in tow and went after the hoses. Don and his father continued on their way, slung the always filled fire pumps across their shoulders, and headed back uphill toward the ever-thickening cloud of smoke and flame.

Ken had not waited for the human

beings to go into action. Pausing only to make certain his armor was still firmly attached to the torpedo, he had seized the control spindle and shot straight upward. He was taking a chance, he realized; but with the relatively cold torpedo hull to smash the initial path through the thin overhanging branches he felt that he could avoid contact with any one of them except for periods too brief to set them ablaze. He succeeded, though a suspicion of smoke floated upward in his wake as he soared clear. The *Karella*, he noted, had done likewise; it now floated a quarter of a mile above the blaze it had started. He wasted no further time on recriminations, even though the chances seemed good that those on board would be listening again.

The fire was not spreading as rapidly as he had feared it might in most directions. On the side toward the house it seemed to have made no progress at all, while along the contours of the mountain its advance was very slow. Upward, however, under the influence of the breeze which had already been blowing in that direction, it was leaping from growth to growth in fine style. Ken saw flaming bits of vegetable tissue borne far aloft on the hot air pillar; some burned out in flight, others settled into the trees farther up the mountain and gave rise to other centers of combustion. A dark-colored growth, apparently dead, a

few yards in advance of the main blaze, smoked briefly in the fierce radiation and suddenly exploded with an audible roar, burning out in less than fifteen seconds and crumbling into a rain of glowing coals.

Ken, unmoved by the prospect of being involved in the uprushing hot gases, maneuvered closer to the blaze. At least part of the reason for the slow advance downhill became evident; the two natives with whom he had been talking were visible through the trees, spraying everything in sight with apparently tiny streams of a liquid at whose nature Ken could only make an educated guess. He watched them for some time, noting that they refilled their containers of liquid every few minutes at a stream of the stuff flowing down near the house, which Ken had not noticed earlier. He wondered where the liquid could have its source, and decided to follow the stream uphill to find out.

As he rose, the extent of the forest country once more was impressed on him, and he began to wonder at the magnitude of the catastrophe the *Karella* had caused. If this combustion reaction were to spread over the whole countryside, the effect on the natives would undoubtedly be quite serious, he decided. He noted that it had spread across the little stream a short distance farther up; apparently the liquid had to be in actual contact with vegetation in order to stop combustion.

The flame and smoke made it impossible to follow the watercourse; Ken dropped lower, reasoning with some justice that the temperature of his armor would do no damage to vegetation already burning, and drifted along only a few feet above the stream bed, barely able to see even then. For the first time he saw animal life other than the intelligent natives; tiny creatures, usually four-legged when they were moving slowly enough for him to see the legs, all fleeing madly uphill. Ken wondered that they could breathe—the smoke suggested that the air should be full of combustion products, and probably was too hot for them; he knew nothing about the fairly common phenomenon of relatively pure air near the ground ahead of a fire. Large scale conflagrations occurred on Sarr, but he was no fireman.

He was ahead of the flames but still in smoke-filled air when he found the source of the stream. He had trouble realizing that it *was* the source; he was no geologist, and a real geologist of his race would have had difficulty in figuring out the mechanism of a spring. Ken rather suspected artificial backing for the phenomenon, but he did not dare touch the liquid to investigate very closely. He would have had grounds for serious worry had he known that a forest fire can sometimes cause a local rainstorm; but that, too, was too far outside his experience. The closest approach to such a thing on Sarr occurred near the poles, where

on very rare occasions meteorological forces so combined as to raise the pressure and drop the temperature enough to cause a slight precipitation of liquid sulfur.

Realizing that nothing more could be learned here at the moment, Ken rose once more into clearer air. Down-hill, the natives seemed to be winning; there was a narrow band of blackened vegetation at the edge of the region of flame which suggested that the fire had burned out in that direction. At the sides, progress was less obvious; but the fire in general had taken on the outline of a great fan, with its handle pointing toward the house and the ribs spreading to a breadth of three or four hundred yards at a roughly equal distance up the mountainside. Through the billowing smoke, Ken could see that the large trees were thinning out at this point, giving way to smaller growths which in turn seemed to follow the usual pattern of yielding to bare rock near the top of the hill. Ken, looking the situation over from his vantage point, decided that the blaze stood a very good chance of eating itself into starvation territory in a very few hours; the natives might very well dispose of the fringes without assistance.

The thought of possible assistance gave rise to another; the smoke was rising in a pillar that must be visible for many miles. Was this likely to bring other natives to help, or would

it be mistaken for an ordinary cloud? Ken's eyes, with their color balance differing as it did from the human, could not be sure of the distinction in hue; but the shape of the smoke pillar seemed distinctive enough to attract attention. With this thought in mind, he decided to call the ship; but when he looked up, the vessel was nowhere in sight. He moved the torpedo back and forth rapidly enough to cause his armor to swing pendulum fashion and give him a glimpse of the sky directly overhead, but there was still no sign of the black cylinder. Apparently Laj Drai's brief taste of Planet Three had been enough. To make sure, Ken broadcast his thought on the matter of further natives arriving, and then returned to his examination of the fire. Within seconds, he had once more forgotten the vessel's existence.

He had found that little could be seen inside the fire itself. This time, therefore, he descended just ahead of the actual blaze, watching through the eddying smoke clouds as the leaves of bushes and small trees in its path shriveled, smoked, and burst into flame sometimes many feet from the nearest actual tongue of fire. Usually, he noticed, the thicker stems did not ignite until they were actually in contact with flame from some other source, but there were exceptions to this. He remembered the exploding tree. He regretted that he had no thermometer, with which he could get some idea of the kindling point of the growths. He

wondered if the oxygen alone could be responsible for such a furious reaction, or whether the nitrogen which made up such a large part of the atmosphere might be playing a part. It had combined with his titanium specimen, after all. There seemed no way of collecting samples of the combustion gases, but perhaps some of the solid residue would tell.

Ken landed in the midst of the fire, brought the torpedo down beside him, opened the cargo door, and threw in several pieces of charred wood. Then he went downhill a short distance, located some grayish ash, and added that to the collection. Satisfied for the moment, he rose clear of the ground again, wondering vaguely how much time, if any, his brief sojourn in the flames would add to the few hours he could remain down. He had heard the thermostats in his armor cutting off several of the heaters during those few minutes; the outer layers must have been warmed up considerably.

In an attempt to guess how long the fire would take to burn out, Ken moved fifty or sixty yards ahead of the flame front and began timing its rate of progress at several points. This proved deceptive, since the rate of travel varied greatly—as any forester could have told him. It depended principally on the sort of fuel available in a given spot and on the configuration of the ground, which influenced the air currents feeding the fire; and those points were both too difficult to



observe for Ken to learn very much about them. He gave up that attempt, moved a little farther ahead, and tried to see what he could of the animals still scurrying away from the most frightful menace that ever threatened their small lives.

It was here that the torpedo microphone picked up a crackling that differed from that of the fire, and a heavy panting that reminded Ken of the sounds he had heard just after his first meeting with Roger. Remembering that he had not seen two of the natives just after the blaze had started, the scientist became a trifle anxious; and two or three minutes' search showed that his worry was only too well founded. Roger and Edith Wing, gasping and coughing from smoke and exhaustion, were struggling almost blindly through the bushes.

The boy's original intention had been to travel across the path of the blaze, to get out of its way—the most sensible course under the circumstances. Several things, however, had combined to make this a trifle difficult. For one thing, after the smoke had become thick enough to prevent their seeing more than a few yards, they had blundered into a little hollow. Using the slope of the ground for guidance, they had made several complete circles of this spot before realizing what had happened. By that time the flames were actually in sight, and they had no choice but to run straight

before them. They simply did not know by then how wide the flame front was; to parallel it at a distance of only a few yards would have been the height of insanity.

They had been trying to work their way to one side while keeping ahead of the flames, but they were rapidly approaching a state of exhaustion where merely keeping ahead demanded all that their young bodies could give. They were nearly blind, with tears streaming down their soot-stained faces. In Edith's case the tears were not entirely due to smoke; she was crying openly from fatigue and terror, while the boy was having a good deal of trouble keeping his self-control.

None of these facts were very clear to the scientist, since even the undistorted human face was still quite strange to him; but his sympathy was aroused just the same. It is possible that, had the same situation occurred just after his first meeting with the natives, he might have remained an impassive observer in order to find out just what the creatures would and could do in an extremity. Now, however, his talk with Mr. Wing and the evidence of culture and scientific knowledge the native had shown gave the Sarrian a feeling of actual intellectual kinship with the creatures below him; they were people, not animals. Also, they had fallen into their present plight while working for him; he remembered that these two had departed in search of specimens for him.

He did not hesitate an instant after seeing them.

He dropped toward the stumbling children, using one of his few English verbs for all it was worth. "Carry!" the torpedo speaker boomed, again and again. He stopped just ahead of the startled youngsters, poised just out of contact with the vegetation. Edith started to reach toward him, but Roger still retained some presence of mind.

"No, Edie! You'll be burned that way, too. We'll have to ride the thing that carries him, if we can get up to it."

Ken had already realized this, and was manipulating his control spindle in an effort to bring the torpedo's tail section within their reach, while he himself was still supported safely above the bushes. He had no intrinsic objection to igniting them, since they were doomed in a few minutes anyway, but it looked as though the young natives were going to have trouble enough without an extra fire right beside them.

The problem was a little awkward, as his armored feet hung two yards below the hull of the torpedo, and the carrier itself contained automatic circuits designed to keep it horizontal while hovering in a gravitational field. It could be rotated on any axis, however; the main trouble was that Ken had had no occasion to do so as yet, and it took a little time to solve the

necessary control combination. It seemed like an hour, even to him, before he succeeded in the maneuver, for he had thrown his full heart into the rescue and was almost as anxious as the children themselves; but at last the rear end of the yard-thick cylinder hung within its own diameter of the ground.

The children at once made frantic efforts to climb aboard. They had no luck; the composition was too slippery, the curve not sharp enough to afford a real grip, and they themselves too exhausted. Roger made a hand-stirrup for his sister, and actually succeeded in getting her partly across the smooth hull; but after a moment of frantic, futile clutching she slipped back and collapsed on the ground, sobbing. Roger paused, indecisive. A blast of hot, smoky air made him gasp for breath; there remained bare moments, it seemed to him, before the flames would be on them. For a second he stared enviously at the helpless being hanging from the other end of the torpedo, to whom the fire's breath was probably a cooling breeze; then he saw the clamps from which the specimen boxes had hung.

For a moment even these seemed useless. He doubted whether he could hang by hand grip alone from those small metal projections for any length of time, and was sure his sister in her present condition could not do so for a moment. Then he had an idea. The clamps were really hooklike, lock-

able devices rather like the clasp of a brooch; fastened, they made complete rings. Roger fastened the nearest, pulled his belt off with a savage jerk, threaded it through the ring, and buckled it again. Hastily urging Edie to her feet—she gained a little self-possession as she saw what he was doing—he did the same with her belt in another ring, not stopping to give thanks that she was wearing dungarees. All the children did in the woods. Then he helped support her while she held to one of the loops of leather and thrust both legs through the other. Some work would still be needed to hold on, but the leg-strap was carrying most of her weight. Satisfied, he waved the Sarrian off.

Ken understood, and his admiration for the human race went up another notch or two. He did not hesitate or argue, however; he knew perfectly well that the boy had found the only likely method of transporting either of them, and even if Ken could speak his language well enough argument would be a waste of time. He took off at once, the dazed girl hanging behind him.

He rose first out of the smoke, to give his passenger a chance to breathe; then he took a good look at his surroundings, to be sure of finding the spot again. A momentary break in the smoke below him showed Roger struggling uphill once more; and without waiting for further observation Ken

sent the torpedo plunging downhill toward the house. Mrs. Wing saw them coming, and he was on his way back for a second load in three quarters of a minute.

In spite of the brief interval and his careful observations, he realized as he arrived overhead that finding the other native was not to be an easy job. His original point of observation was reached easily enough; but he discovered when he arrived there that with the total lack of instruments at his disposal and the moderately strong and erratic air current obviously present there was no way for him to tell whether he had risen vertically to that point, or whether he would be descending vertically from it. He had, of course, seen Roger after getting there, but the boy had already been in motion. He could also cut his lift entirely and fall vertically; but that line of action did not recommend itself. The torpedo was a heavy machine, and he had no desire to have it drop on his armor, especially in the gravity of this planet. He did the best he could, letting down to ground level as rapidly as seemed safe and starting a regular search pattern over the area.

Where he landed, the fire had not quite reached, though the bushes were beginning to smoke. There was no trail such as the boy might have left, or at least none that Ken could recognize. Playing safe, he moved downhill to the very edge of the fire and searched back and forth across it for fifty yards

each way — a considerable distance, when the visibility was less than a tenth of that. Then he began moving his sweep gradually up the hill.

Roger had made more progress than might have seemed likely, considering the condition in which Ken had left him; it was fully ten minutes before the scientist found him, still struggling on but making practically no progress. He must have actually gained on the fire during at least part of that time, however, the Sarrian realized.

He sent his booming call downward, and once more lowered the tail of the torpedo. Roger, with a final effort, got his legs through one of the straps, and folded his arms through the other. His face was within an inch or two of the torpedo hull, which had been heated considerably by its recent passage along the flame front; but anything was better than staying where he was, and Roger was scarcely conscious of the blistering on his hands and face. Ken, once sure that the boy had a good grip, plunged up into clear air and bore his second burden down to the house. Roger was still holding on when they arrived, but it was hardly a conscious effort—his mother had to unlock his frantic grip by force.

Ken, knowing he could do no good around the house, went back uphill above the treetops to see how the others were making out in their fire fighting, leaving the presumably com-

petent adult to care for the rescued children. The need for effort seemed to be decreasing; the lower portion was definitely burned out, it seemed to him, and the only activity was along the upper edge. The men were still at work soaking down the edges as they worked upward, but the really lively area had long since outrun them. It was, as Ken had rather expected, heading for bare rock and fuel starvation; but it would be many hours yet before it died completely. As the Wings were perfectly aware, it would be a source of danger for days if the wind should shift, and they did not let up for an instant in their effort until forced to do so by sheer exhaustion.

Twice during that period Ken landed on bare patches near Mr. Wing and sketched a rough map of the situation on the ground. Once he hugged ground between trees himself for many minutes while a stiff-winged, three-engined metal machine droned overhead; again he concealed himself as a group of men, bearing water pumps and other fire-fighting tools appeared on the trail from Clark Fork and passed on uphill to help. Ken remained in the vicinity of the house after that; he did not particularly want to be seen by these new natives, reasoning that much delay to his language progress would ensue. He may have been right.

It was shortly after the arrival of the new group that Mr. Wing and

Don appeared at the house, almost ready to drop. They were scratched, soot-stained, and scorched; even Ken could appreciate the difference from their former appearance, for they appeared in even worse shape than Roger and Edie had been. It was then, for the first time, that Mr. Wing learned of the danger and rescue of the two, for Ken had made no attempt to apprise him of the matter—it was too difficult, with his limited grasp of English, to manufacture adequate phrases.

Mr. Wing had the same trouble, after he heard the story. Ken had already judged that the race must have strongly developed ties of affection; now he was sure of it. Mr. Wing could not find the words to express himself, but he made the fact of his gratitude amply clear.

XIX.

The *Karella* had indeed left Earth's atmosphere, but had not returned to her previous height. Two-way communication had been re-established—Ken wished he knew just when—and Feth was once more controlling the torpedo which carried the scientist. The process of getting aboard was no more complicated than usual. Ken left the two "live" boxes in the air lock for the time being, having set their refrigerators to the same power as the first had seemed to require; the other two, partly filled with mineral specimens, he brought inside. Draï

greeted him rather sourly as he emerged from his metal chrysalis.

"So you're finally back. What did you get, if anything?" Ken eyed him with the closest approach to a defiant expression he had yet worn.

"Very little. Thanks to the slight distraction you seem to have engineered, the natives had other things to do than talk to me."

"How was I to know that the ship's hull would set off a chain reaction in the local vegetation? I should think if anything could do it, it would have happened long ago from some other cause."

"I seem to recall telling you of the danger myself. And it may have happened before; the natives seemed to have fairly well organized means of dealing with it."

"Then the fire is out?"

"Not quite. It will probably react for some hours yet. What I dislike is your habit of assuming that I am either a liar or a fool. I told you what happened to the piece of vegetation I picked up; I told you what I was doing with the native in the matter of learning his language. You were listening to me most if not all of the time. What possessed you to come down the way you did?"

"Because I doubted what you told me." Draï made the statement without circumlocution; he apparently felt he was on secure ground. "You said that there had been no talk between you and the native on the subject of

tofacco; you even said that you doubted that this was the same native we've been trading with."

"I said I wasn't sure he *was* the same. That's minor, though—go ahead."

"The first day, while you were down talking to him, the signal came from the fixed transmitter, indicating that they were ready to trade."

"I should think that would support my veracity. I was not near the transmitter. Ask Feth—he landed me."

"That's what I thought, for a while. But today, which was the usual interval after a signal, I sent down another torpedo while you were having your 'language lesson'—and nothing happened! There was no one there."

"You mean no one gave you any tofacco."

"No one took the metal, either. I'd be willing to believe they were trying to cheat me, if it had gone without anything in return; but that doesn't fit. I decided you had let something slip while I wasn't listening, and came down to see what you were up to."

"Skipping for the moment the question of how I could possibly tell whether or not you were listening, I'm not sure whether to be glad you think me stupid rather than dishonest. I agree that my native may be your trader, in that case; he might have decided to go to the transmitter later in the day; after he had talked to me. He knew I couldn't stay long. In that case, you have only yourself to thank

that he didn't go later—he was too busy. Also, a couple of the young ones were nearly killed by the chain reaction; he may not be too pleased with you now, if he's connected the ship and the trading business. After all, remember he knows we come from Planet One on these trips."

"That I don't believe. He couldn't possibly know it. That's another reason I decided you were trying to cover up your own indiscretion. How do you know that two of the natives were endangered by the fire?"

"I saw them. As a matter of fact, I rescued them—rode them out of the way on the torpedo. I spent quite a while investigating the whole thing, since once you'd started it there was nothing else for me to do. I can prove that—I got some specimens of vegetation residue that may give some more information about the planet."

Drai eyed him silently for some moments.

"I'm not convinced yet, and you'd better convince me before your next drug-hunger comes due. If they're going to stop trading, I'm going to stop distributing free samples."

Feth, in the background, emitted an uncontrolled sound that was the equivalent of a gasp of dismay; Ken permitted an anxious expression to reach his face for a moment. He had had one brief experience of tofacco-hunger now, and did not want a prolonged one.

Drai nodded as he saw the expression. "Yes. The stock is not very high, and if it's to be the last, I'm going to get value for it. I have been given an idea from what you just told me. If this tale of having rescued two natives from death by overheating is true, you can just go back down and play on their gratitude. You can make out that *you* want to trade for to-facco. Surely they will gratify the hero who pulled them from terrible death. Particularly if he makes it clear that he's in for a very uncomfortable time if they don't. You go right back down—your armor's warmed up by this time. We haven't pulled in the other torpedo yet; as soon as you go on local control down there, we'll send it over to you with the metal, and you can haggle to your heart's content." He ceased, still wearing a definite sneer.

"The fact that my knowledge of the language is still fragmentary does not bother you?"

"No. I think you know more than you say."

"How about the fact that there are, at the moment, many other natives at the scene of the fire? I kept among the trees when they arrived so as not to be seen, but I can't do that and trade at the same time. Do you want me to work out in the open? They'll all be fire-fighting for a while, but I suppose they'll want metal afterward." He paused. "I don't see how they can *all* be the one you've been trading with. But I suppose you don't mind opening

new bargains with the others—"

Laj Drai interrupted. "You can wait."

"Oh, it wouldn't take very many torpedo loads of metal to satisfy them all, I'm sure."

"I said you could wait." Drai must have seen the satisfied expression that flickered for an instant on the scientist's face, for he added, "I have another idea. The *Karella* will go down with you, and both watch and listen. Possibly if the native becomes recalcitrant, we can suggest lighting another fire."

"Now you want the natives to get a good look at a full-sized spaceship. You don't care much about the law, do you?"

"You ought to know. Besides, they've seen it already. However, we'll wait—for a while. I rather think we'll land at a little distance from the scene of the fire, and drop in when it's out. That way," both eyes fixed themselves on Ken, "we'll be sure who talks, and for how long." He turned, pushed off from a convenient wall, and glided out of sight along the corridor.

Feth followed him with one troubled eye.

"Ken, you shouldn't use that tone of voice to him. I know you don't like him—no one could—but remember what he can do. I thought, after you'd had a taste of that, you'd calm down a bit. Now he's likely to hold out on you just for the fun of it."

"I know—I'm sorry if I've got you in trouble too," replied the scientist. "I just think he's safer when angry. While he's gone, now, we'll have to talk fast. There's work to be done. First of all, was he telling the truth about the short supply of tofacco? Does he keep it all in that refrigerated safe that he hands out our doses from?"

"Yes. And he's probably telling the truth; most of the stuff goes back to the Sarrian system at the end of the season, and he doesn't keep much on hand."

"How much constitutes a dose? I didn't get a really good look at what was inside the brick of frozen air, either time."

"A little cylinder about so big." Feth illustrated. "It comes that way, only in longer sticks—he cuts them into ten sections, and freezes each one up for a separate dose."

"All right—that's what I wanted to make sure of. Now, how good are the little refrigerators on those vivaria of mine? Will they freeze air?"

"Sure. Why?"

"You'll see. Right now, I imagine I have another acting job to do; I don't suppose anything would stop Draï from going down to the surface of Three, as he said." Without explaining anything more, Ken headed toward the control room of the interstellar flier.

He was quite right; the impatient drug runner had already ordered the

pilot down once more. Lee was making no objection this time, though his expression was not actually one of delight. The descent was uneventful, practically a repetition of the earlier one, except that they were homing on the fixed transmitter and consequently were some eight miles east of their former point of landing. They stopped at a height of two miles above the nearest peaks, and looked around for the smoke cloud. Rather to Draï's disappointment, they saw it; even their eyes could distinguish it from the regular clouds without much difficulty.

"It still seems to be burning," Ken remarked innocently. "Are we going to drift here in full sight until they put it out?"

"No. We'll go down and hide."

"Among the plants? That doesn't seem to work so well, as a method of concealing this ship."

Draï eyed the scientist for some time, obviously near the limit of exasperation. "I'm looking after the matter, thank you. The vegetation does not grow everywhere, as even you should be able to see. There, for example." He pointed to the south. A triangular patch which gave a metallic reflection of the sky light lay in that direction. It was one of those Ken had noticed on his first descent. "We'll look that over. It seems to be lower than the surrounding territory, and would make a very good hiding place. If it's really like the sort of ground the flatlanders live on, these

other natives may very well avoid it. How about that, scientist?"

"You seem to have some logic on your side," Ken replied equably.

Drai made no answer to this; he simply gestured to Lee, and the pilot obediently slanted their line of descent toward the shiny patch.

With radio altimeter registering five hundred feet, Ken began a careful examination of the area. It was larger than he had guessed from a distance, and he found himself unable to decide on its nature. The planet had some queer minerals, of course; the brief look he had had of the specimens he had just brought in showed that. Directly below he could make out no details at all; but over near the edge of the area, the trees that rimmed it were reflected—

"*Lee! Hold up!*" The pilot obeyed without thought, stung by the urgency of his tone.

"What is it?" The eternal suspicion was lacking even from Draï's voice, this time.

"It's a liquid—see how the reflection at the edge trembles in the air currents!"

"So what?"

"The only liquid I've encountered on this planet behaved an awful lot like that queer oxide we found on Four—the one that nearly froze my feet. I saw some before here, and dipped a handler in it; the stuff vaporized instantly, and it was minutes before I

could put a tentacle in the sleeve again. I think it's that heat-drinking stuff—hydrogen oxide."

"Why didn't you mention this before?" The suspicion was back in Draï's tone.

"What chance have I had? Besides, I don't care if you leave yourself a frozen memorial on this planet—it's just that I'm with you at the moment. If you don't want to believe me, at least put a torpedo down on it first. You must have plenty of those."

Even Draï could find no fault with this suggestion, and he gestured to Feth. The mechanic, with a glance at Ken, went to his control board and without comment launched another of the projectiles. The one Ken had used was available, but it was the only one fitted with manual control, and he did not want to waste it. He was already convinced of the correctness of Ken's hypothesis.

The slim projectile appeared outside the control room port, and drifted gently down to the surface of the lake. It was still hot, having been stowed inside the ship; and contact with the liquid surface was heralded by a burst of steam. Feth hastily lifted it a short distance, and waited for it to cool somewhat.

"Hardly a fair test to cool it off that fast," he said. "Something's bound to give."

Presently he lowered the machine again. This time only ripples marked

the contact. Very cautiously Feth forced it still lower, while the others watched silently. Apparently the cold did not matter.

But something else did. Quite suddenly another cloud of steam arose, and a wave of considerable size spread from the place where the torpedo had been. *Had been* was the right expression; there was no response when the mechanic manipulated the controls to bring it up again. He glanced up, presently.

"It's a pity that only the cargo compartments of those things are air-tight. Apparently the liquid bothers electrical machinery. Maybe it dissolves insulation."

Laj Draï was looking as though he had seen a ghost. He made no direct answer to the mechanic's remark.

"Ken!" he spoke suddenly, still looking preoccupied. "When you first described this patch of stuff, you said its appearance reminded you of the flat country. Right?"

"Right." Ken saw what the drug runner had in mind.

"Would it . . . would it be possible for a planet to have so much liquid that three quarters of its surface would be covered?"

"I certainly can't say it's impossible. I admit it's hard to imagine. Any liquid at all — and particularly something as rare as that stuff is with us. Still, this is a larger planet than Sarr, and would have a greater velocity of escape, and is colder so the average

speed of the gas molecules would be slower . . . let's see—" His voice trailed off as he became involved in mental arithmetic. "Yes, this planet would hold the stuff easily enough; and hydrogen and oxygen are common elements in the universe. I'm afraid it's very possible, Draï."

The other did not answer; everyone else knew what he was thinking. When he did speak, Ken felt smug—he had predicted the subject correctly.

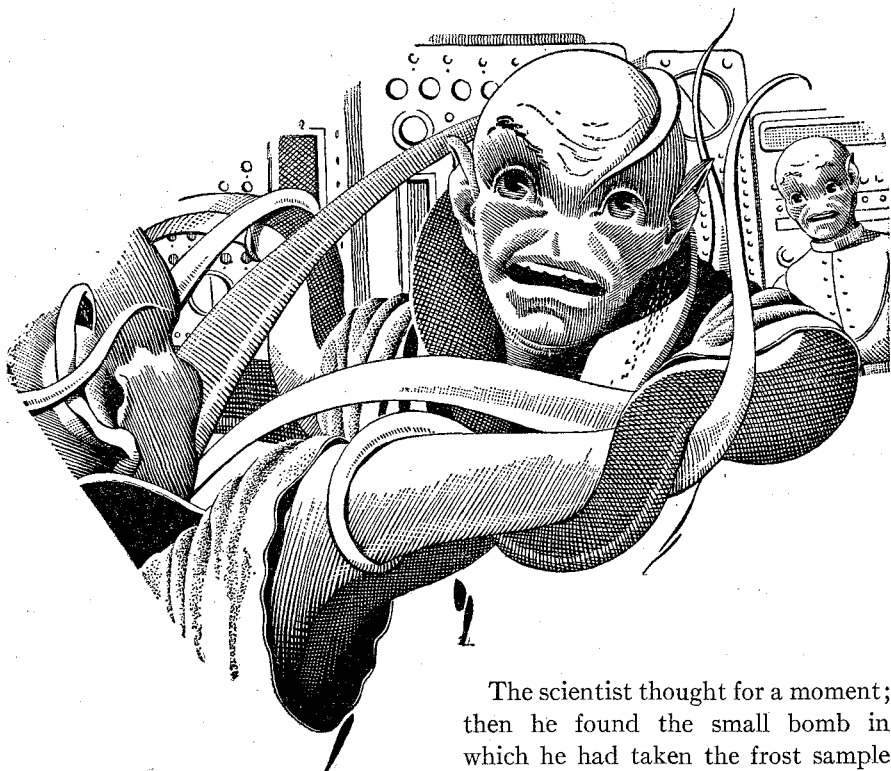
"But the flatlanders—could they live in the stuff? Maybe there aren't any; the liquid must have destroyed the torpedoes—But their radar beams! We've detected those!" He looked at Ken suddenly, as though he had made a telling point in an argument.

Ken had been following his thoughts well enough to answer. "You have no evidence whatever that those beams were not generated by the same race with which you have been trading. I have already pointed out that they are competent astronomers. I think you have been developing a very interesting mythology for the last twenty years, though I admit the idea could do with a little more proof."

Keeping one eye on the enigmatic liquid beyond the port, Draï rolled the other toward the pilot.

"Lee, go up about ten miles, and start traveling. It doesn't matter which way, I guess." He was obeyed in silence.

Even though Lee did not take the



shortest route to the ocean, the speed of the ship even within the atmosphere was such that only minutes passed before the fabulous "flatland" lay beneath them—the closest any of them had dared to approach it in twenty Sarrian years. Dumbly the commander gestured downward, and presently they hung a few hundred feet above the waves.

Drai looked for a long time, then spoke three words to Ken: "Get a sample."

The scientist thought for a moment; then he found the small bomb in which he had taken the frost sample on Mars, pumped out the air, and closed the valve. Redonning his armor, he clumped into the air lock after voicing dire warning to Lee about keeping the vessel level. He fastened a wire to the bomb itself and another to the valve handle; then, opening the outer door, he lowered away until the loss of weight told him the bomb was submerged. He pulled the other wire, waited a moment, pulled up the filled bomb, closed the valve again, and sealed the outer door of the air lock.

Naturally, the bomb exploded vio-

lently within a few seconds of the time that sulfur ceased condensing on its surface. Ken felt thankful that he had not yet removed the armor—parts of the bomb had actually scored the metal—and after some thought tried again. This time he let down a tiny glass wool sponge, hoping the liquid had a significant amount of natural capillary action. He placed the sponge in another bomb, and by the same method he had used with the Martian sample eventually determined the molecular weight of the substance. It came out higher than before, but eventually he found the deposit of salts on the sponge and allowed for their weight. The result this time left little doubt that the substance was indeed hydrogen oxide.

He looked down for a minute at the tossing blue expanse, wondering how deep it might be and whether it would have any real effect on the conditions of the Planet of Ice; then he turned, climbed out of the armor—he had stayed in it for the rest of his experiment, after the first blast—and went to report to Draï.

The drug runner heard him in silence. He still seemed a little dazed by the overthrow of his former belief. It was many minutes before he spoke, and then he simply said, "Take us back to One, Lee. I have to think." Ken and Feth eyed each other, but kept all expression of glee from their faces.

Draï's certainty was gone.

"Well, you seem to have done it now." Feth was still unhappy.

"In what way?" queried Ken. The two were ostensibly engaged in checking the mechanical adequacy of the refrigerated vivaria.

"I've been working for years to support this flatland myth—I realized it was never more than a theory, but Draï had to be shown the difference between that and fact—and I've been doing my level best to keep the production of tofacco down to a minimum."

"Provided it was not cut off entirely," Ken interjected rather unkindly.

"True. Now you blow up the story that kept him scared of really exploring the planet, and at the same time give him a tool for getting what he wants from the inhabitants by threats and force. If you had any ideas in mind at all, they seem to have flopped badly."

"Oh, I wouldn't say that. You saw the way Draï was feeling when he left the ship."

"Oh, yes, he was regretting the wasted years and the money that went with them, I suppose. That won't last much longer; he's been mooning for days now. Then he'll—"

Ken had been thinking furiously as the mechanic delivered his gloomy discourse; now he interrupted abruptly.

"Then he'll be too late to do any-

thing. Feth, I want you to take me on trust for a while. I promise you won't miss your sniff. I'm going to be very busy in the air lock for at least a couple of hours, I imagine. Lee is still aboard. I want you to find him, and keep him occupied in any way you see fit for at least that length of time. I don't want him to see what I'm doing. You have known him longer than I, and can figure out something to interest him. Just don't kill him; we're going to need him later."

Feth looked at the scientist for several seconds, obviously doubtful. Ken wisely said nothing more, letting him fight his own battle with a perfectly natural fear. He was pleased but not too surprised when the mechanic finally said, "All right," and disappeared toward the control room.

Ken waited a moment; then, reasonably sure of not being interrupted, he closed the inner door of the air lock, donned a regular spacesuit, and set briskly to work. He was rather regretful of the need for sacrificing some of his living specimens, but he consoled himself with the thought they could easily be replaced later. Then, too, the vivarium he had to use was the one containing only a few plants—the fire had interrupted before the human children had made much progress with it. That was foresight, not good fortune; he had had to decide which of them he was going to use, before he had left the planet.

This work meant final results!

In the control room, Feth did not find his task too difficult. He was not on the best of terms with the pilot, but had never held toward him the blazing hatred he had felt toward his chief. Lee was not particularly scrupulous, as he had shown in the past, but Feth knew of nothing in his record to call forth whole-souled detestation. In consequence, there was nothing strange in the mechanic's entering the control room and settling down for a talk. The pilot was reading, as usual when off duty; to his question concerning Ken's whereabouts, the mechanic responded that he was "fooling with his vegetables in the air lock."

"Why does he have to use the lock for a laboratory?" the pilot asked plaintively. "I've already told him it's bad practice. He's got a lab in the station—why doesn't he take them there?"

"I guess he figures if a refrigerator breaks down he can pump the air out of the lock and have a chance of the specimen lasting until he can make repairs," Feth replied. "I imagine you'd have to ask him, to be really sure. I wouldn't worry—there are just the three of us aboard, and those cases aren't too big to get around if your engines start to get out of hand."

The pilot grunted, and returned to his reading; but one eye flickered occasionally to the board of telltale lights. He knew when Ken evacuated the lock and opened the outer door, but apparently did not consider it

worth while to ask why.

Feth, as a matter of fact, did not know either; he was wondering a good deal harder than Lee. Fortunately the pilot was used to his taciturnity and habitual glumness of expression, or his attitude might have aroused suspicion. It was, as a matter of fact, his awareness of this fact that had caused Ken to refrain from telling his whole plan to Feth. He was afraid the mechanic might look too happy to be natural.

The next interruption caused the pilot to put down his book and rise to his feet. "What's that fool doing now?" he asked aloud. "Drilling holes in the hull?"

Feth could understand the source of his worry; the outer door of the air lock had been closed again, and pressure had returned to normal some time before—but now the pressure was dropping rapidly, as though through a serious leak, and air was being pumped *into* the chamber. The outer door was still closed.

"Maybe he's filling some portable tanks," suggested Feth hopefully.

"With what? There isn't a pump on board that could take air faster than the lock bleeders can deliver it, except the main circulators. He's not using those, where he is."

"Why don't you call him and ask, then? I notice the inner door is sealed, too; he'd probably have a fit if you opened it in the middle of his work."

"I'll have one myself if this goes

on," growled Lee. He watched the indicators for another moment, noting that the pressure now seemed to be holding steady at about half normal. "Well, if it's a leak, he had sense enough to plug it." He turned to the microphone, switched to the local wave length used in the suit receivers, and made the suggested call.

Ken answered promptly, denying that he had bored any holes in the hull and stating that he would be through shortly. Lee was able to get nothing else from him.

"One would almost think you didn't trust him," gibed Feth as the pilot turned away from the microphone. "You have as much reason to believe him as you have to believe me, and I notice you don't worry about me."

"Maybe after he's had a few more sniffs I'll feel the same about him," Lee replied. "Right now, just listening to him makes me think he's not convinced yet about being under the influence. I never heard anyone talk like that to Draï before."

"I did—once."

"Yeah. But he's done it more than once. Draï feels the same way—he told me to camp in this control room as long as you two were on board. I don't think it matters, myself—I've got the key, and if anyone can short the whole control system out from under a Bern lock he's darned good. However, orders are orders." He relaxed once more with his book. Feth resumed his gloomy train of thought.

So they're trusting on just that one hold on us. As if I didn't know it. If Ken could figure out some means of getting at Drai's cold-safe—I certainly have never been able to—but then, we couldn't find Sarr anyway—if only we were looking for a sun like Rigel or Deneb, that a fellow could recognize at thousands of parsecs instead of having to get close enough to spot planets—his thoughts rolled on, consisting largely of "If only's" as they had now for years. The drug had done little if anything to Feth's mind, but the fact of his subjection to it had long since given him an apathetic attitude toward all suggestions for escape. He wondered why he had consented to do as Ken asked—how could the scientist possibly keep the assurance he had given?

Ken's own voice eventually interrupted this line of cogitation. "Feth, could you come down here to help me for a moment? I'm nearly through; there's some stuff I want to take out of the lock." Both Sarrians in the control room glanced at the indicators. The lock pressure was rising again.

"All right, I'm coming," replied Feth. "Get the inner door open as soon as pressure's up." He started down the corridor, leaving the pilot behind. Ken's message had been well worded.

He was not gone long enough to make the pilot suspicious; within two or three minutes Lee heard both mechanic and scientist returning. They were not talking, and as they ap-

proached the pilot grew curious. He started to rise to meet them, but had time just to reach his feet before the two entered the door. The gloomy expression had left Feth's face, to be replaced by one much harder to decipher. Lee, however, spent no time trying to solve its meaning; his eyes were both drawn instantly to the object the two were carrying in a cloth sling between them.

It was roughly cubical, perhaps a foot on a side. It was yellow in color. It trailed a visible stream of mist, and yellow droplets appeared and grew on its surface—droplets of a deeper, honey-colored hue; droplets that gathered together, ran down the sides of the block, soaked into the sling, and vanished in thin air. For an instant Lee, watching it, showed an expression of bewilderment; this changed almost at once to one of horror; then he regained control of himself.

"So that's where the air was going," he remarked. "What's the idea?"

Ken, who was clad in a spacesuit except for the helmet, did not answer the question directly. Instead, he asked one of his own.

"You know the co-ordinates of Sarr, and could get there from here, don't you?"

"Of course. I've made the trip often enough. So what—I hope you don't think I'm going to tell you in order to get out of a frostbite."

"I don't care whether you want to tell us or not. I plan for you to do the

piloting. And I don't plan to freeze you on this block—in fact, we'll put it down right here. You have until it evaporates to make up your mind. After that, we'll be in a position to make it up for you."

The pilot laughed. "I was expecting that one. Am I supposed to believe you have some tofacco in the middle of that? You just made the block a couple of minutes ago."

"Quite true. Since you bring up the matter, there is a cylinder of tofacco inside the block. I put it there myself—a few minutes ago, as you say."

"I suppose you broke into Laj Drai's safe and borrowed it." The pilot was obviously incredulous.

"No. However, Drai's suggestion of playing on the sympathies of the natives of Planet Three was a very good idea."

"I suppose they gave you a hundred units for rescuing their kids."

"As a matter of fact, it seems to be more like two thousand. I didn't exactly count them, but they're very neatly arranged; and if the unit you mean is one tenth of one of the cylinders they come in, that figure is about right." The pilot might have been just a trifle uneasy.

"But there weren't any landings after Drai had the idea—you couldn't have asked for it."

"Are you trying to insult me by saying I had to wait for Drai to have such an idea? I thought of it myself, but having been brought up with a

conscience I decided against trying it. Besides, as I keep saying, I don't know their language well enough yet. As it happened, the native I'd been talking to gave me a container of the stuff without my mentioning it at all. He seems to be a nice fellow, and apparently knows the value we place on tofacco. I fear I forgot to report that to Drai."

Lee looked positively haggard as the likelihood of the story began to impress him; Feth, on the other hand, had brightened up amazingly. Only a slight expression of doubt still clouded his features—could the scientist be running a bluff? It seemed impossible; it was hard to see how getting started for Sarr would do any good unless he had a supply of the drug, and he had made no mention of forcing Lee to help them get it from Drai's safe.

These points must have crossed the pilot's mind, too; he was looking at the dwindling lump of sulfur with a growing expression of terror. He made one last objection, knowing its weakness even before he spoke.

"You won't dare let it out—Feth has no suit, and you don't have a helmet."

"What difference does it make to us?"

With that, Lee made a sudden, frantic break for the door. He dived headlong into Feth, and for a few seconds there was a nightmarish swirling of legs and tentacles. Ken stood

by, but his assistance was not needed. The pilot suddenly rolled back almost to his control board, tentacles lashing madly; but when he regained his feet, he did not seem eager to renew the struggle.

"If I'd only had—"

"Yes—it would have been very nice if Draï had let anyone but himself carry a gun. The fact is, he doesn't; and you haven't too much time. How about it?" Feth emphasized his words by turning up the control room thermostat, which was within his reach.

The pilot gave in. If any shred of doubt about Ken's truthfulness remained in his mind, he did not dare gamble on it—he had seen drug addicts other than Feth, and remembered some harrowing details.

"All right—take it away!" he gasped. "I'll do whatever you want!"

Without comment Ken picked up both ends of the sling and carried the now much lighter bundle back toward the air lock. He was back in two or three minutes.

"Made it!" he said. "I was wondering if it might not boil through before I got there—you held out longer than I thought you would, Lee. However, the air is clear after all. I may mention that that particular block is the top one in my little refrigerator, and it will take remarkably little time to bring it into action.

"Well, let's make plans. I'd rather like to arrest our friend Draï, but I don't quite see how we're to go about

it. Any ideas?"

"Arrest him?" A faint smile suddenly appeared on Feth's face.

"Yes. I'm afraid I'm some sort of deputy narcotics investigator—not that I asked for the job, and certainly I'm not a very efficient one. Maybe I ought to swear you in, too, Feth—I guess I can do it legally."

"You needn't bother. It was done more than eighteen years ago. Apparently they didn't bother to tell you that the stunt of taking an innocent general science dabbler and trying to make a policeman out of him had been tried before, with no visible results?"

"No, they didn't. I'll have something to say to Rade when we get back. If he knew that—"

"Take it easy on him. Under the circumstances, I'm very glad he tried again. You haven't done such a bad job, you know."

"Maybe not, but the job's not done. I see the reason now for a lot of things that puzzled me about you. As far as I'm concerned, this is your show as much as mine, from now on. How do we go about collecting Draï? I suppose the others aren't worth bothering with."

"Why not leave him where he is? There's no other ship; he's stuck as long as we have this one, unless he wants to take a ride in a torpedo. Since there's nowhere else in this system where he could live for any length of time, I don't think he'll do that.

My advice would be to take off right away, and let him worry about what's happened until we get back with official support."

"The motion is carried—except for one thing. I have to run a little errand first. Feth, you keep an eye on our friend and pilot while I'm gone." He disappeared toward the air lock before any questions could be asked.

As a matter of fact, his absence was quite long, and eventually the ship had to go after him. He was in a valley adjacent to that of the station, with a problem he could not handle alone. Sallman Ken liked to pay his debts.

None of the Wings, of course, felt that the strange "fire-man" owed them anything. On the contrary. They did not blame him for the fire—he had been on the ground, talking to them, when the ship started it. The blaze was out by night, anyway, with the aid of the crew from Clark Fork. The only real concern the family felt was whether or not the alien would return.

It was not until evening that anyone remembered that a torpedo load of metal should have arrived that day. Don and Roger went out in the morning to the site of the transmitter, and found a torpedo, but its cargo door was closed and there was no answer to their shouts. This, of course, was the one Draï had sent down, and which he had completely forgotten in the rush of events. It had been operating on

radio rather than achronic transmitter control, since the *Karella* had been so near at the time, and there was no way to switch it back from a distance even if the drug runner's memory should improve.

Ken himself, with his "payment" safely on board the *Karella*, never thought of it; his attention had promptly switched to the obvious need for a survey of the Solar System before he left it. A full Earth day had been spent looking briefly over Sol's frozen family, before he could be persuaded to start for home—Feth did not try very hard to persuade him, as a matter of fact, since he had his own share of scientific curiosity. At last, however, they plunged back to make the final call at Planet Three. The transmitter was just emerging into sunlight; this time even Lee appeared willing to home down on it. A mile above the peaks, Ken guided him on a long downward slant to a point above the Wing home.

The natives had seen them coming; all seven of them were standing outside, watching the descent with emotions that Ken could easily guess. He waved Lee into a position that brought the air lock directly over the clearing in front of the house, and the lowest part of the ship's hull thirty feet above the treetops. Then he climbed into his armor, entered the air lock with his "payment," and opened the outer door without bothering to pump back the air. For a moment he was envel-

oped in a sheet of blue fire, which burst from the port and caused the natives to exclaim in alarm. Fortunately the flame of burning sulfur licked upward, and was gone in a moment. Then Ken, waving the natives away from directly below, rolled his payment over the sill of the lock.

It made quite a hole in the ground. A carefully made diagram, drawn on the fluo-silicone material the Sarrians used for paper, followed; and when the Wings looked up after crowding around this, the *Karella* was a dwindling dot in the sky, and Ken was already preparing a report for the planetary ecologists and medical researchers who would return with them. Perhaps a cure for the drug could be found, and even if it weren't he was on good enough terms with the natives so that he needn't worry too much. Not, of course, that that was his only interest in the weird beings; they seemed rather likable, in their own way—

He even remembered to write a brief report for Rade.

On the ground, no one spoke for some time.

"I can't budge it, Dad," were the first words finally uttered. They came from Roger, who had been vainly trying to move the grayish lump that had landed at their feet.

"It must weigh two hundred pounds or so," supplemented Don. "If it's all platinum—"

"Then we'll have a fine time breaking it up into pieces small enough to avoid comment," finished his father. "What interests me right now is this picture." The others crowded around once more.

It was a tiny diagram of the Solar System, such as they had drawn before the fire two days ago. Beside it was the unmistakable picture of a spaceship like the *Karella*—heading away from it. Then another diagram, apparently an enlarged view of the orbits of the inner planets, showed the arcs through which each would move in approximately a month; and finally a third picture reproduced the first—except that the spaceship was pointing toward the system. The meaning was clear enough, and a smile broke out on Mr. Wing's face as he interpreted it.

"I guess we continue to eat," he remarked, "and I guess our friend wants to learn more English. He'll be back, all right. I was afraid for a little while he'd take that carton of cigarettes in the wrong spirit. Well—" he turned to the family suddenly.

"Don—Roger—let's go. If he's going to be away a month, and that torpedo is still lying where you found it, we have a job of tinkering to do. Roger, by the time you're Don's age you may be able to pilot us on a return visit to your hot-blooded friend—we're going to find out how that gadget works!"

THE END



THE REFERENCE LIBRARY

BY P. SCHUYLER MILLER

COLLECTIVELY SPEAKING

The collecting "instinct," it is now clear, is particularly strong among readers of science fiction. Some of them merely buy and hoard everything of the kind ever printed. Others, presumably the results of a mutation of high survival value, collect stories and republish them in the form of anthologies. And 1951, with seven major collections already out—as of September 1st—and at least four yet to come, should go down as the Year of the Anthologies.

The year was opened by Martin Greenberg with the second of his "theme" anthologies, "Journey to Infinity" (Gnome, \$3.50), organized as an imaginative history of mankind, past, present, and future, and only slightly less successful than his "Men Against the Stars" (Gnome, \$2.95) of last year. He now promises to close the year with a third super-duper with color illustrations by Edd Cartier and a "dictionary" of science fiction terms, to be called "Travelers of Space" (Gnome, \$3.95) and dealing with life on other worlds. It should be out by the time this appears, as should

all the books mentioned here as forthcoming.

Two other old hands at anthologizing have been well represented. Groff Conklin, in his fifth collection, "Possible Worlds of Science Fiction" (Vanguard, \$2.95), has followed a theme much like that used last year by Donald Wollheim in his "Flight into Space" (Fell, \$2.75). The result, which incorporates stories from seven different sources, is among the best of his now-standard anthologies. August Derleth, even more of a veteran than Conklin, with nine editing jobs to boast of, has produced a kind of complement to last year's "Beyond Time and Space" (Pellegrini & Cudahy, \$4.50) with another, much more readable selection, "Far Boundaries" (Pellegrini, \$2.95), ranging in source from 1797 to 1950. He is scheduled to have still another, "The Outer Reaches" (Pellegrini), out in October. These historical anthologies of Derleth's are providing readers with a shelf of source-books to accompany such studies as J. O. Bailey's "Pilgrims Through Space and Time."

Donald Wollheim's 1951 anthology is entitled "Every Boy's Book of Science Fiction" (Fell, \$2.75). Wollheim, whose fifth science-fantasy collection this is, has become oddly uneven in his selections of late. This book, intended to serve as an introduction to science fiction for teen-agers, is unfortunately old-line in themes and writing. There is nothing easy about

the task Wollheim set himself—that of finding scientifically instructive, well written stories which would appeal to boys—but the result is not at all satisfactory, though some top-notch writers are included.

Two "giants" of science fiction have at last tried their hand at assembling collections of stories which they like and consider worth calling to the attention of general readers. Murray Leinster, with "Great Stories of Science Fiction" (Random House, \$2.95), has a volume which is short enough and well enough balanced so that it can be read almost at a sitting, like a good novel. If you have a friend who can't see what you see in the stuff, try him—or her—on this. Such stories as Shiras' "In Hiding" and C. L. Moore's "No Woman Born" should convert almost anyone. Fletcher Pratt, in his turn, offers "World of Wonder" (Twayne, \$3.95), with a higher proportion of less obvious authors represented. The outstanding example is Franz Kafka's short novel, "Metamorphosis," but he adds such unfamiliar names as Esther Carlson and Gouverneur Morris as well as O. Henry and Rudyard Kipling. Kendall Foster Crossen has also provided a number of unfamiliar stories and "new" writers—Walter Van Tilburg Clark, for example—in his excellent "Adventures in Tomorrow" (Greenberg, \$3.50), so far as I know his first venture as a science-fiction editor. "Unfamiliar," as used here, it must be admitted, is

practically a euphemism for stories from other magazines than ASF.

Two other forthcoming anthologies have been announced, which should be out by the time this round-up appears, and which sound like "must" items. One is the annual Bleiler-Dikty "Best Science-Fiction Stories: 1951" (Fell), due in September. Past performance has shown that this pair will have no difficulty at all in justifying their choices—which, despite the title, will be the best of 1950.

The greatest, but most promising, unknown quantity of the fall is "New Tales of Space and Time" (Holt, \$3.95), scheduled to appear about the time this issue reaches the newsstands. Raymond J. Healy, co-editor of "Adventures in Time and Space" (Random House, 1946), has persuaded ten authors to do ten original stories on ten different themes, all with an "up-beat" of optimism to counteract the traditionally gloomy outlook of current writing. Included are Anthony Boucher, Ray Bradbury, A. E. van Vogt, Kris Neville, Gerald Heard, Reginald Bretnor, Cleve Cartmill, and Frank Fenton, with Isaac Asimov and your reviewer representing America east of the Sierras.

All of these books have been or will be reviewed more fully in due course. But if you're starting your Christmas buying now, you should have enough to go on if you decide to make this a Science-Fiction Anthology Christmas.

TIME AND AGAIN, by Clifford D. Simak. Simon and Schuster, New York. 1951. 235 pp. \$2.50

"Time and Again" is something of a rarity in these days, a major science-fiction novel which was not first serialized in this magazine. Those who know Simak only from such space-operas as his "Cosmic Engineers"—Gnome Press—may find the span to this new book amazing, but those who have followed the author's development through these pages will know what to expect.

Here is an absorbing, intricately plotted idea-tale in the vein of a van Vogt "Null A." It is the story of Galactic Agent Asher Sutton who comes back from death, after twenty years on the closed world of 61 Cygni, with strange powers and a stranger knowledge of the ultimate kinship of all living things throughout the universe. He is at once embroiled in a galactic intrigue reaching across Time from the Eighty-fourth Century to his own year of 7990, and thrusting back its tentacles to our own immediate future. For Asher Sutton is the author of a book in which he has set down the truth of the symbiotic partnership which he calls "Destiny"—and which mankind of the future will try to interpret as a manifest destiny for born-humanity, while the race of androids, made-humanity, struggle to preserve the truth which makes them partners in Destiny with every other living thing. When this book will be

written, how it will be written, and what will be written in it are the questions which are moving worlds, races, and times with Asher Sutton as the pivot.

It is the super-man theme again, if you will—but Ash Sutton is a very human, very likable superman.

RENAISSANCE, by Raymond F. Jones.
Gnome Press, New York. 1951. 255
pp. \$2.75

“Renaissance,” when it appeared here seven years ago, was at once hailed as one of the most memorable novels Astounding SCIENCE FICTION has ever published. It still stands as a strangely moving book, overcoming its lack of characterization and other traditional shortcomings by a drive and sweep of imagination which it will be hard to find in any of the other current offerings.

This is a story of two worlds—the remnants of a self-destroyed Earth, and Kronweld, the strangely tortured world in another plane to which mankind has exiled the most promising of his scientists-to-be. Through a hundred thousand years or more the two worlds have struggled upward along divergent paths—Kronweld a world without birth, save through the fiery curtain of the Temple, a world dedicated to Seeking yet barred by custom and religion from searching out the truths of life, the stars, and its own

origins—Earth torn by its own inner conflicts, half-aware of its child-world, half afraid of what may come out for it. And in the tortuous relationships among the people of the tale, it is never quite certain who is of what world, of what persuasion, or of what intents: Ketan, the hero, driven by his dreams; Elta, lover and determined enemy; old Matra of the Temple; the fantastic Richard Simons and the even more unbelievable Dorien; and behind them all the mystery of Igon, first of Kronweld to pierce the Edge which separates Kronweld from Earth.

This is the kind of tale which has a touch of “The Moon Pool” and “The Blind Spot” in it, and of “The Night Land.” You’ll probably either like it very much, or dislike it just as vehemently.

THE DISAPPEARANCE, by Philip Wylie.
Rinehart & Co., New York. 1951.
405 pp. \$3.50

In its mechanism this book is science fiction, or at least a fantasy as well worked out as the author’s “Worlds Collide” collaborations with Edwin Balmer, now being filmed. Its purpose is the analysis of some of the shortcomings of our society, and in particular the relationships between the sexes. In this respect it is to be classed with such novels as Orwell’s “1984” or Huxley’s “Ape and Essence” rather than with main-stream science fiction.

The author has emphasized the in-

equalities and inequities between mankind and womankind by separating males from females for four grim years. His cataclysm, whatever it may be, sets up parallel worlds, physically identical at the moment of disappearance except that in one there are men only, and in the other women only. Men, in whose hands the mechanical side of our culture is held, have the best of it at first. Then they dive into a mercifully short atomic war, an orgy of bureaucracy, and a tidal wave of lawlessness. Women, confronted with the physical breakdown of their society—fires which cannot be put out, machines they cannot operate—patch up a working internationalism with their Soviet sisters but find themselves at the mercy of hurricane and disease. After four years of division all is restored to the moment of the disappearance, except that the castaways have the memory of their years apart.

Through his chief protagonists, Dr. William Gault and his wife Paula—philosopher and one-time career woman—and in auctorial asides, the terrible-tempered Mr. Wylie takes many opportunities to reflect caustically and keenly on some of the psychological perversions of Western society. Even as a well worked out story the book is absorbing, but the reader who goes beneath the surface will have every reason to squirm at this hawk's eye view of what the author, in another book, has called our "generation of vipers."

GREAT STORIES OF SCIENCE FICTION,
 edited by Murray Leinster. Random House, New York. 1951. 321 pp. \$2.95

Although the title is a misnomer probably imposed by the publisher to parallel his previous "Great Tales of Terror and the Supernatural," Murray Leinster, with knowing-kindness, has indeed assembled one of the very best science-fiction anthologies now in print.

The common element of a selection which ranges from as slight an item as Cleve Cartmill's tricky little tale of an intellectualized rabbit, "Number Nine," to such movingly human classics as Wilmar Shiras' "In Hiding" and C. L. Moore's "No Woman Born," is a deft humor of situation, well conceived and nicely handled. These stories are fun to read, and they should make friends for science fiction among a good many "laymen."

In addition to the three stories already mentioned, the book contains Michael Fessier's comedy-of-worlds from the *Saturday Evening Post*, "The Fascinating Stranger," the editor's own "Symbiosis" from *Collier's*, with its deceptively simple solution to biological warfare, and one out of place fantasy from *Unknown*, Malcolm Jameson's mixture of the Devil with time travel in "Blind Alley." The oldest, Ralph Milne Farley's story of an intelligent virus, "Liquid Life," and the newest, "Number Nine," are from one of Astounding SCIENCE FICTION's

top contemporaries, as is Oscar J. Friend's "The Impossible Highway" with its inexplicable and unexplained roadside museum of evolution.

The rest of the collection has come from these pages. Mr. Leinster's own "The Strange Case of John Kingman" is a pleasant variation on the man-from-the-future theme. Anthony Boucher, in "The Chronokinesis of Jonathan Hull," develops logically and consistently the living-backward idea which was handled so cavalierly in Ross' novel, "The Man Who Lived Backward"—reviewed in *Astounding SCIENCE FICTION*, May 1951. Lewis Padgett's usual deftness gives a new twist to the robot theme in "Open Secret," and Ted Sturgeon closes the book with his excellent gadget story, "The Chromium Helmet."

Given a lazy Sunday you can read the whole book at a sitting without indigestion, thanks to its pace and variety. Murray Leinster would make a mighty fine science-fiction editor if he ever grows tired of writing for a living.

MEN OF OTHER PLANETS, by Kenneth Heuer. Pellagrini & Cudahy, New York. 1951. 165 pp, ill. \$3.00.

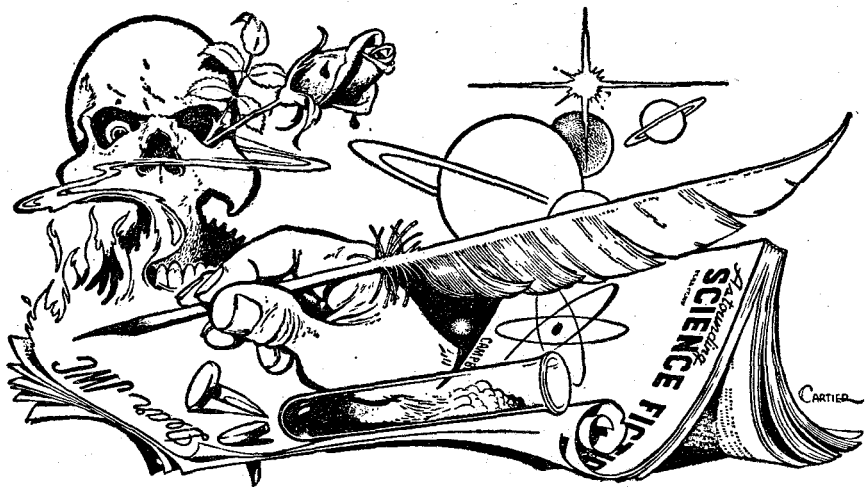
This handsome little book by a lecturer at the Hayden Planetarium in New York, well illustrated with block prints by R. T. Crane and numerous charts of the solar system and its planets, should have had a much handsomer text.

The author forestalls criticism by admitting his indebtedness to the French writer of the last century, Camille Flammarion—indeed, in places the style of the book reads like pure Flammarion, and the concepts of the intelligent "men" who, it is suggested, may inhabit the various planets are in the Victorian-romantic tradition—e.g. the "thinking and talking trees" of Venus. On the credit side, the author describes many or most of the latest findings as to the physical conditions on each planet, and has added a table which describes the telescopic and naked-eye appearance of each to a terrene observer.

This is a good enough book but it should have been much better.

THE END





BRASS TACKS

Dear Campbell:

I'd like to congratulate you on the "quantum jump" Astounding has made in the art and story departments in the last two months. I'd have written before but I was waiting to see if you could keep it up. You have.

A note on Daniel Whitton's "No Green Cheese": It is *not* generally agreed by astronomers that lunar craters are caused by meteors. I don't know any serious lunar observers in this country who believe it!

There's a sentence in this article that shows how dangerous it is to make negative predictions nowadays.

Whitton remarks, *re* the lunar dust layer "Our experimental limitations keep us, of course, from probing farther beneath." Actually, Australian radio physicists, working on 24,000 Mc/s, have already got about a meter inside the Moon! They have shown that the dust layer is probably only about 1 mm thick, with solid rock underneath. For full details, see "Microwave Thermal Radiation From The Moon," J. H. Piddington and H. C. Minnett. (Aust. J. Sci. Res. 2, 63-77—March 1949). Gold's theory did seem a little too ingenious to be true!—Arthur C. Clarke, London, N 22, England.

*Radio reaching out 238,000 miles to
finger moondust!*

Dear Mr. Campbell:

Williamson's "The Greatest Invention" has set me to thinking for the past week as to just what are the laws of thought. Williamson himself carefully refrains from sticking his neck out; but I would like to get my two cents' worth into the general melee that is to follow his yarn.

Good Korszybskyite that I am, I think that one law precedes all others; indeed, that without the first law, thought is impossible.

1. Delayed action. A simple reflex is not thought. A movement of the leg in response to the stimulus of a hammer is purely—reflex. Likewise, the instantaneous—or nearly so—reaction to a person's name, color or shape of nose is also not thought, for it is an unthinking reaction to a stereotyped stimulus. The thalamus is not enough for thought; the cortex must be given time to work.

Under this first law, come the five steps of the scientific method—thanks to Dr. Dewey:

- a. Analyze the question for meaning.
- b. Gather all the available facts you can.
- c. Prepare one or more hypotheses, remembering that they *are* hypotheses.
- d. Test the hypotheses' results

against the world of phenomena.

- e. Select the best hypothesis, remembering that it is always subject to alteration or discard upon the discovery of new facts.

2. Once you have created a theory, it is *not* a fact—witness the downfall of the Newtonian Universe, which was accepted as law. In other words, all knowledge must be regarded as tentative. In still other words, keep an open mind to new phenomena; recognize that you should try not to color new events with old concepts.

3. Thinking requires looking at the world objectively, as though you had never seen it before. You see a tree every day; you call it a Douglas Fir; it is part of your world. Yet it can be processed into many things if you do not accept it as merely a part of your environment.

Finally, I think I would go along with Dewey in believing that successful thought is problem-solving, or mental trial-error-and-success.

For the An Lab: all the stories were on a high level, and hard to choose from. Perhaps because "The Greatest Invention" had the greatest thought content, I put it first. "Feedback," a real gem, second. "Windfall," "The Error of their Ways" and "For those who Follow After" are a three-way tie for third; I really can't choose. "The End of the Line" comes last—I know Schmitz is supposed to be good,

but the only story of his I have ever really liked was "The Witches of Karres."

With regard to serials, by all means let's have them. They are one of the main reasons that the old ASF's are so much in demand. Where are the good novels going to come from if you drop serials? Please!

The magazine is improving in stories lately, but deteriorating in covers. How about a Rogers like the one for "Fury" and Williamson's "The Equalizer"?—H. T. Barker, 2836 Birch Street, Vancouver, B. C., Canada.

Man's master tool is thought—and considering that, it's rather remarkable we know so little about it!

Gentlemen:

I'd like to take this opportunity to make a few comments on "The Care and Feeding of Mad Scientists," in the July, 1951, issue. The author made several worthwhile points, and he displayed good humor; but his writing seems rambling and full of digressions. I disagree with the author in his conclusion that scientists are weak, thin, and under muscled. I believe that it has been well established that people with high intelligence tend to be larger, sturdier, and healthier than average. It is my subjective impression that an average physicist is a better-than-average physical speci-

BRASS TACKS

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men. Perhaps the "conclave of salesmen or politicians" would turn out to be pretty soft under all the noise?—A. W. Solbrig, Jr., 307 Wesley Hall, Vanderbilt University, Nashville 4, Tennessee.

I understand, too, that geniuses usually are unusually powerful physically, with abnormally long life-span.

Dear Mr. Campbell:

I read with a great deal of interest your comment on Page 123 of the September, 1951, issue of Astounding, in which you state that the element Neptunium "... has a half-life of 12.5 days."

According to the General Electric Chart of the Nuclides, vintage 1951, the following isotopes of Neptunium are known:

Mass Number	Half Life
231.....	53 minutes
233.....	35 minutes
234.....	4.4 days
235.....	435 days
236.....	22 hours
237.....	2.2×10^6 years
238.....	2.1 days
239.....	2.3 days

Nowhere can I find the figure 12.5 days listed as a half-life for an isotope of Neptunium. The isotope of mass 237 shows some promise of sticking around long enough for most mortals, in contradiction to the insinuation in the mentioned comment.

I agree with the basic idea of your statement, as I understand it; that is, the AEC releases so little information of any use that it's a little silly. True. However, there are some changes being made, all to the good, I think. I would refer you to the latest issue of *The Review of Scientific Instruments*—of all places!—in which an excellent description of the Los Alamos water boiler is given, together with the effective nuclear cross-section of U-235 and the critical mass of Plutonium in solution. This is a direct result of recent high-level declassification conferences, and should lend a lot of impetus to the declassification of reactor information.

I feel, though, that you should give your researcher a sharp rap on the knuckles about that 12.5 day half-life. Probably he was referring to the element Mythium, whose physical constants are variable—we run across it a lot in our work.—R. E. Nather, Richland, Washington.

The error was mine; I hadn't checked recent data. But the Np-239 made by pile reaction lasts less than I thought. The declassification program now under way is a fine one, and I'm planning some first-rate articles based on it. My comment on the patent wasn't a jibe at AEC declassification, but amusement at some of its inevitable strange results. The idea of mass-produced neptunium fluoride (life 2.3 days) still intrigues me.

Dear John:

Subject is military dispatches, now known as "messages" in Armed Forces parlance. I'm not a "communicator" by any means, but have put in some ten years of service with the United States Marines, reading dispatches of one form or another, and would like to bring up a few points concerning military message traffic that many of my favorite authors in ASF seem to be rather ignorant concerning.

In the first place, a military message is as terse, clipped and complete as possible, and should approach the ultimate in simplicity for obvious reasons. All messages have a classification; that is, they are either "plain," "restricted," "confidential," "secret," "top secret," or some other higher classification. All messages have a certain precedence, also, indicating when they are to be placed on the wire by order of importance—as "deferred," "routine," "priority," "operational priority," "emergency," "flash," and so on. I've even seen a few flash op-op messages in my time, particularly recently in Korea, where emergencies seemed to be the order of the day! All messages have date-time groups also, by which they can be filed for later reference, a number assigned in accordance with the message center's system of processing messages and the time the message was received. The message TOR—time of receipt—is normally indicated

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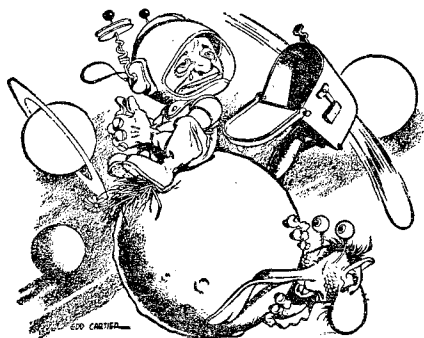
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somewhere on the dispatch, also, and all messages received are marked as "action" or "information" messages by someone in the message center or by the organization's staff secretary, so that the various copies will reach their appropriate destinations.

I don't want to bore you, but none of these common-sense requirements are ever followed in ASF by even my favorite authors, when they send dispatches for one reason or another in the course of their interplanetary or interstellar wars—and the habit lately has been to quote the dispatch in full, too, just as the reader presumes he would see it in the code room of the spaceship or office of the story's hero.



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Take the message appearing in Harry Stine's "Galactic Gadgets" for example. That dispatch would never have been released by the Chief of Staff of any unit I've ever served in. It was not only loaded with redundancies and unnecessary verbiage but also failed to include certain necessary details, such as specific *times*, et cetera, so that it was a complete mess, from the military man's point of view. I mean this as no real criticism of Stine's fine story, but a more realistic example *would* have helped. I think that particular dispatch *should* have read something like this (remember, I'm no dispatch drafter, but merely an infantry officer who's read plenty of dispatches in his time):

From: HQ TSN TERRA

Precedence: AAA

To: ALL TSN SHIPS AND
STATIONS

Classification: XXX

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BASE X ALL FLEET UNITS
STAND BY X TSN OPERATION
ORDER 1-51 FOLLOWS X REIN-
HART SENDS

(The name and rank hocús-pocus in
Stine's dispatch was all unnecessary.)

My vote for the stories in that issue
is as follows:

1. "Izzard and the Membrane"
2. "Galactic Gadeteers"

3. "Guess Again"
4. "Success Story"
5. "Key Decision"

Best regards, and congratulations
on a fine picture in "The Thing." —
John M. Birdwell, 1st Lt. USMC.

*Thanks for the tips! Many of our writ-
ers can do a fine lab report—but not
so many have military experience!*

Dear Mr. Campbell:

From your note on Page 123 of the
September issue concerning an indus-
trial process for the production of nep-
tunium tetrafluoride, I infer that you
think a compound containing an ele-
ment with a half-life of 12.5 days will
be of negligible value. If I am wrong,
I apologize.

If you have this mistaken belief,
however, I refer you to the following
report from Page 50 of the September
1951 issue of *Scientific American*:

"Abbott Laboratories acquired private facilities in Oak Ridge to process radioactive isotopes for medical use. One reason for the move is the increasing medical interest in radioactive gold for the treatment of inoperable chest tumors. The half-life of this isotope is only 2.7 days, so pharmaceutical processing at the point of production is necessary to speed it to the user."

Additional information concerning the Abbott plant at Oak Ridge and their work with radioactive isotopes may be obtained from an article on

Page 3642 in the August 20, 1951 issue of *Chemical and Engineering News*. It is reported in this article that sodium 24 has found great value in certain applications. It has a half-life of 14.9 hours.

Surely a science fiction editor shouldn't have difficulty in believing in something unusual. — Carl Wm. Kammeyer, 605 East Healey Street, Champaign, Illinois.

Na is easy to get: even Au is obtainable. But who has the Neptunium oxide to start with?

☆ ☆ ☆ ☆ ☆

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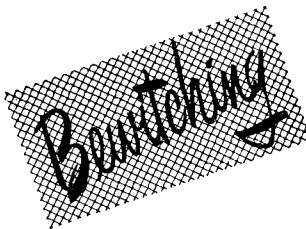
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